The New Zealand

Journal of Agriculture.

VOL. XXIV.—NO. 1.

WELLINGTON, 20TH JANUARY, 1922.

THE CATTLE-TICK AND OTHER TICKS IN NEW ZEALAND.

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SOME considerable amount of confusion seems to exist among stockmen with regard to the identity and relationships not only between the cattle-tick and other species in New Zealand, but also between the cattle-tick of this country and those of Australia. It is the object of this article, therefore, to present as far as possible the characteristics of the ticks as a whole, and more particularly of the various species of ticks in the Dominion.

STRUCTURE AND HABITS OF TICKS.

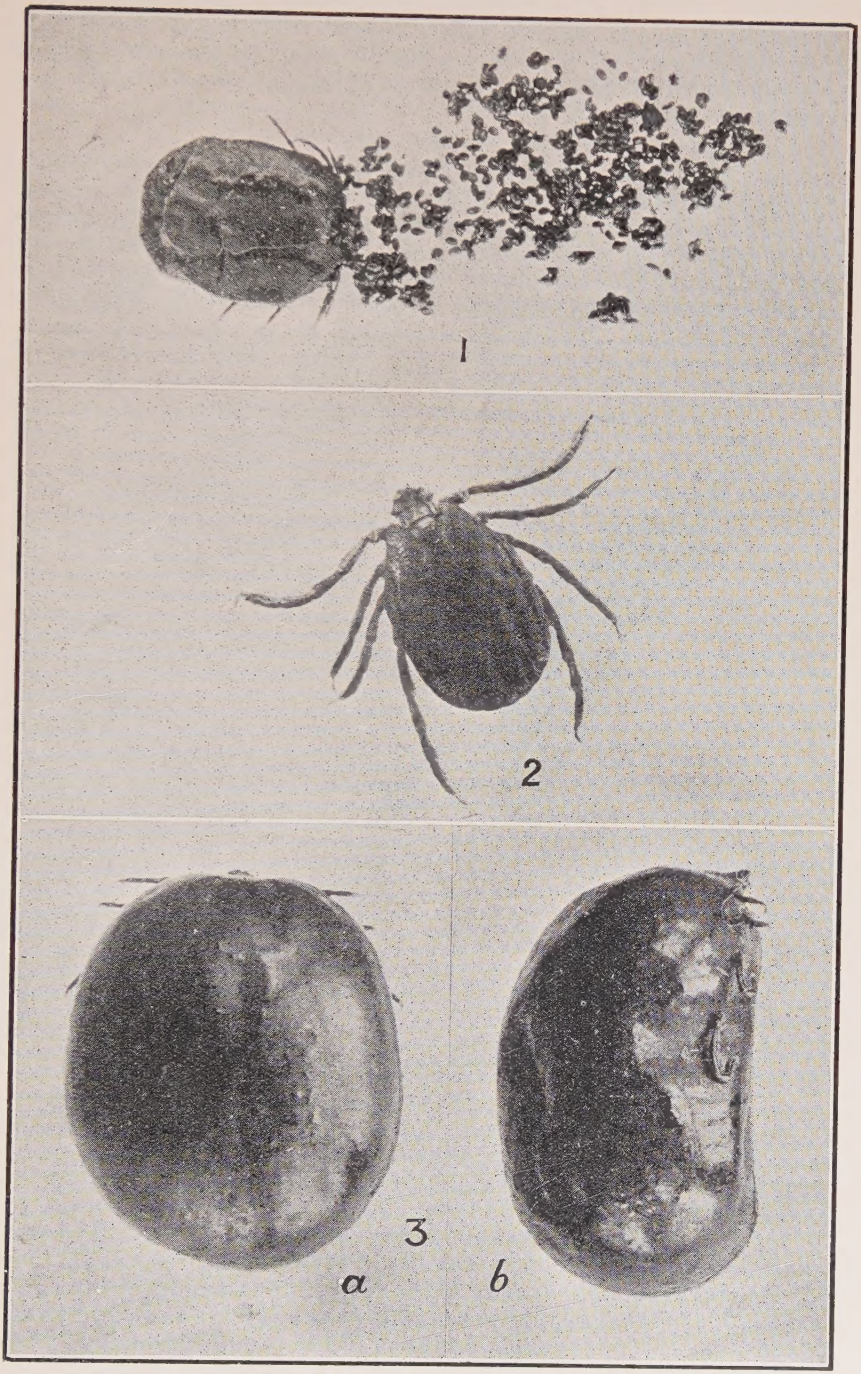
Ticks, together with mites (such as sheep-scab mite and mange mite), are known collectively as the *Acarina*, forming a group of the arachnids to which all spiders belong. They are not insects. The chief differences between ticks (or any other arachnids) and insects are that the adults of the former are eight-legged, are never winged, and the head is not developed as a separate region ; the latter are six-legged, frequently winged, and the head forms a separate freely movable region articulated to the body. The body of the tick is more or less flat and oval in outline, but when engorged with blood it becomes considerably distended and globular ; on each side below and more toward the front

end are attached four jointed legs, each terminated by a pair of small claws which enable the tick to cling to the animal upon which it lives. The piercing-beak or rostrum is attached to the front end of the body, and when the tick is engorging itself with blood it is difficult to remove without tearing off the rostrum, which remains in the flesh of the host animal, or pulling away a portion of the skin attached to the rostrum. A magnified examination shows that the reason for this lies in the armature of the rostrum consisting of numerous recurved "teeth."

In the life of a tick there are four stages. When the adult female has become fully engorged she drops from the host animal and seeks some near-by shelter among the grass on the ground. There she lays her eggs, which vary from hundreds to many thousands according to the species. This is the first stage (Fig. 1). The eggs having been laid, the mother dies. In due course a minute six-legged larva (second stage) hatches from each egg, and in the case of the cattle-tick crawls up to the top of grass-blades, where large numbers may be found congregated, waving their front legs about with the instinctive purpose of seizing hold of and alighting upon any cattle beast which passes. Having alighted upon its host, the larva seeks a favourable spot, and, driving its rostrum through the skin, has its first meal of blood. This being accomplished the larva casts its skin and transforms to an eight-legged nymph (third stage), which, like the larva, engorges and then sheds its skin. This transformation results in the adult males and females (fourth stage—Fig. 2). Even then the ticks are comparatively small, but, of course, larger than the larvæ or nymphs. After copulation the female commences to draw blood from the host animal, and, becoming greatly distended, drops to the ground and commences egg-laying as before.

Some species of ticks remain on the one animal from the larval stage to the adult, but others drop to the ground at each stage and transform off the animal. Each time this occurs they have to climb up the grass and await a passing host. There is therefore a much greater mortality among the latter forms, since a great many must necessarily starve, but this is counterbalanced to a great extent by their wonderful fasting-powers and the greater prolificness of the female. Each species of tick usually confines itself to one species of animal, although some ticks infest a variety of hosts.

Ticks are not only injurious on account of the quantity of blood they drain from domestic animals, which in consequence may become very poor in condition, but they are also the agent by means of which the micro-organisms of certain diseases are transferred from the blood of one animal to that of another. In New Zealand no such tick-borne diseases occur among the domestic animals, and it is therefore only as parasites that ticks are detrimental, but as such they may seriously hinder the development of and even kill the animals they infest. A computation based on experiments made by the United States Department of Agriculture showed that a steer weighing 1,000 lb. if heavily infested with ticks will lose as much as 200 lb. of blood in a year. Another experiment showed that when a tick-infested and low-conditioned animal weighing 730 lb. was cleaned of ticks it gained 385 lb. in two months. As each tick has three meals of blood it must absorb a considerable quantity comparatively, as is well illustrated by the



NEW ZEALAND CATTLE-TICK (HAEMAPHYSALIS BISPINOSA).

Fig. 1. Female laying eggs. Fig. 2. Unengorged female. Fig. 3. Fully engorged female—(*a*) seen from above, (*b*) seen from side. All magnified.

extraordinary size to which a fully engorged adult female will become distended (Fig. 3). It is thus very readily seen that the effect of ticks upon the development of beef cattle or the supply of milk results in a considerable loss.

TICKS IN NEW ZEALAND.

Since, with the exception of two species of bats, there are no terrestrial mammals indigenous to New Zealand, the indigenous species of ticks are, so far as is known, mostly confined to the native birds, and are not injurious from a humanistic aspect. With the introduction into New Zealand of domestic animals two species of exotic cattle-ticks have reached our shores, one of which has become abnormally prolific upon

cattle in the North Auckland district, while the other, fortunately, is rarely met with, and apparently has not yet succeeded in establishing itself sufficiently to become injurious. These two species, together with the indigenous ones, make a total of ten species present in the Dominion, as follows :—

(1) *Haemaphysalis bispinosa* Neum. (cattle-tick of New Zealand) ; (2) *Haemaphysalis leachi* And. (on huia) ; (3) *Hyalomma aegyptium* Linn. (on huia) ; (4) *Ixodes ricinus* Linn. (the European tick) ; (5) *Ixodes eudyptidis* Mask. (penguin-tick) ; (6) *Ixodes apteridis* Mask. (North Island kiwi-tick) ; (7) *Ixodes aptericola* Mask. (South Island kiwi-tick) ; (8) *Ixodes anatis* Chilton (grey-duck tick) ; (9) *Ixodes intermedius* Neum. ; (10) a species infesting the tuatara lizard (to be described in the near future).

Of these species *Haemaphysalis bispinosa* is the only one extensively established in New Zealand, and is the well-known cattle-tick of the North. With the exception of *Ixodes ricinus*, which so far is infrequently found in the Dominion, the other species are restricted mostly to native birds; one occurs on the tuatara (*Sphenodon punctata*).

Haemaphysalis bispinosa.

This tick, which recently has become prominent in connection with cattle in northern New Zealand, has a fairly wide distribution. It occurs in British East Africa, throughout India, in Ceylon, Burma, Assam, Andaman Islands, Malaya, China, Japan, Borneo, New South Wales, and New Zealand. It does not restrict itself to one particular animal, but parasitises several species of domestic and wild mammals as well as some birds. In this country it infests cattle for the most part, but is exceedingly common on hares and rabbits, while it frequently attacks sheep, dogs, and domestic fowls; in some cases horses are heavily infested, and occasionally man.

There is no record of how this tick reached New Zealand, but for over twenty years its presence has been known, although it is only within the last few years that it has become so abnormally prolific as to become a prominent pest of cattle. At the present time it is restricted to the Auckland Province, where it prevails throughout the North Auckland Peninsula and the greater part of the Coromandel Peninsula. As shown by the accompanying map, it also occurs in other widely separated areas. These localities are (1) on the east coast of the Great Barrier Island; (2) in the vicinity of Papatoetoe, south of Auckland City; (3) on the Hauraki Plains, near Thames; (4) in the vicinity of Hamilton and (5) Frankton Junction; (6) at Hinuwera; (7) near Te Puke; (8) south of Whakatane; and (9) at Opotiki. (The numbers correspond with those on the map.) The distribution of this tick therefore lies west of 177° 20′ E. and north of 38° 5′ S.*

H. bispinosa is blackish or reddish-brown in colour, although at times individuals may be greyish-white, several specimens found on a horse being of the latter colour. The fully engorged female (Fig. 3) has more or less the shape of a pea, and measures just under $\frac{1}{2}$ in. long by a little less than $\frac{1}{3}$ in. across; several delicate whitish lines are clearly seen radiating over the posterior end of the body in such individuals. The male measures about $\frac{1}{12}$ in. long, and the female before engorging is somewhat larger. The rostrum is a small, short projection seen at the front end of the body (Fig. 4*a*), and is a character by which the species of the genus *Haemaphysalis* may be recognized from those of *Ixodes*, which have a comparatively long rostrum (Fig. 4*b*). The eggs of *H. bispinosa* are laid on the ground (Fig. 1) among pasture, and the larvæ are found on the ends of the leaves or upon the flower-heads of the grass. In the North Auckland Peninsula where paspalum-seed is harvested the larvæ or "seed" ticks occur among the collected seed.

Haemaphysalis leachi and Hyalomma aegyptium.

The only record of these two species occurring in New Zealand is an interesting one. Upon some specimens of preserved huia (*Neomorpha*

* Particulars regarding the distribution of the cattle-tick in the Dominion are from information supplied by the Director of the Live-stock Division.

acutirostris) skins, collected thirty-eight years ago by Buller and recently sent to Britain, a number of *H. leachi* and *H. aegyptium* were found still attached to the wattles of the birds.* Both these ticks have occurred upon wild and domestic mammals and birds in other countries, and occur in India and Africa. *H. leachi* is found also in Transcaucasia, Sumatra, Java, Borneo, Federated Malay States, and New South Wales, while recently specimens taken from a dog were sent to the writer from Samoa. *H. aegyptium* occurs in Arabia, Russia, West Indies, Argentina, and North Australia. Mason suggests that these ticks

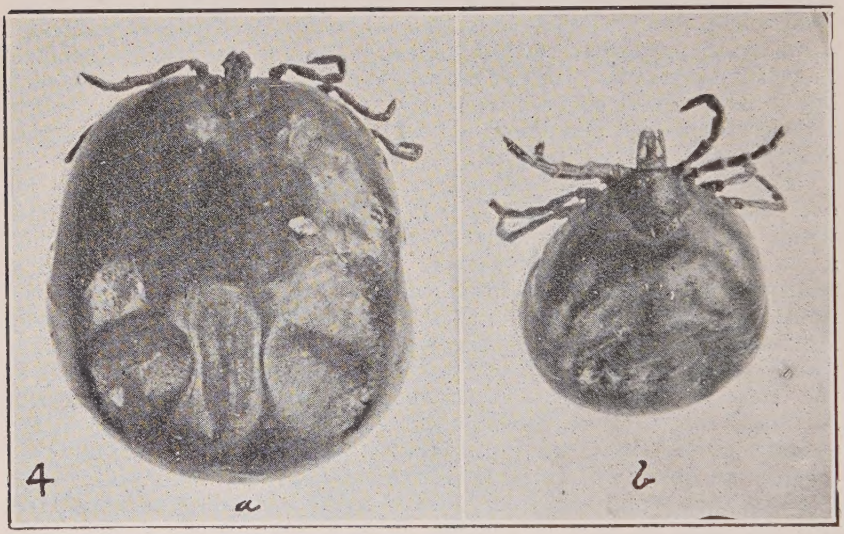


FIG. 4. (*a*) CATTLE-TICK (HAEMAPHYSALIS BISPINOSA); (*b*) NORTH ISLAND KIWI-TICK (IXODES APTERIDIS). SHOWING DISTINCTION IN LENGTH OF ROSTRUM. MAGNIFIED.

were brought from India to New Zealand on the mina (*Acridotheres tristis*), which was introduced in 1875, the ticks having been found on these birds in Burma and Calcutta.

Ixodes ricinus.

This tick is not usually met with in New Zealand, the writer having received only a single specimen taken from a horse. It occurs in Europe, Asia, Japan, North America, and Africa, and infests various species of mammals, including cattle.

Ixodes eudyptidis.

In 1885 Maskell named and described this tick, which was found in the gape of a penguin at Dusky Sound.

*G. E. Mason, "Observations on certain External Parasites found upon the New Zealand Huia," *Transactions of the New Zealand Institute*, Vol. 53, p. 357.

Ixodes apteridis. (Fig. 4b.)

This is the tick frequenting the North Island kiwi (*Apteryx mantelli*), and in the cattle-tick area it is frequently assumed that *Haemaphysalis bispinosa* infests these birds. As already indicated, an examination and comparison of the rostrums of the two species will at once distinguish them. This tick has been found on kiwis in Taranaki and in the North Auckland Peninsula.

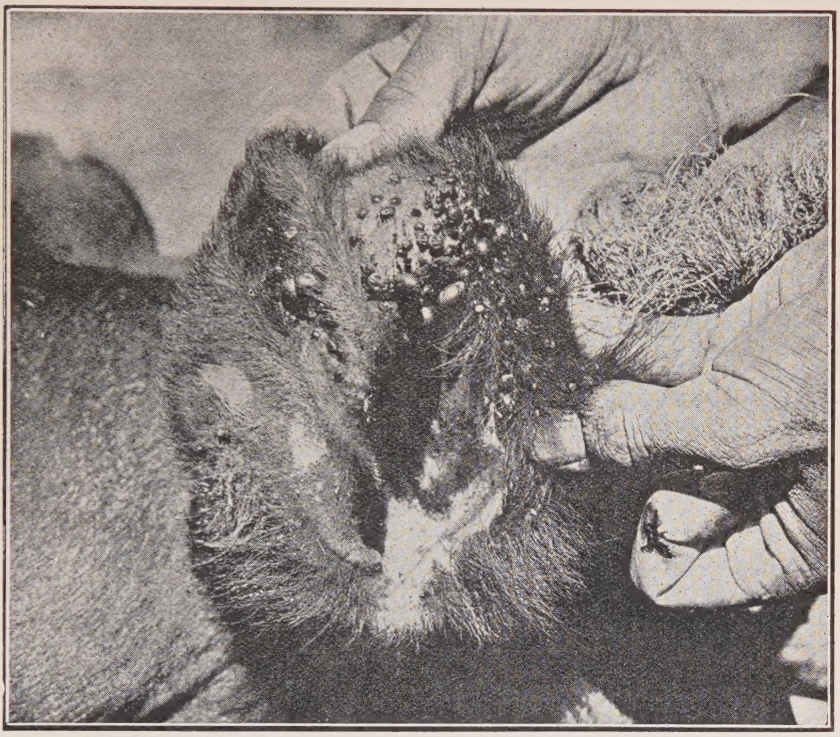


FIG. 5. COW'S EAR INFESTED BY TICKS (HAEMAPHYSALIS BISPINOSA).

Ixodes aptericola.

This species was found at Dusky Sound on the South Island kiwi (*Apteryx australis*). It is larger than *I. apteridis*, from which it differs in many structural characters.

Ixodes anatis.

Dr. C. Chilton named and described this tick, which was found by Mr. W. W. Smith upon the grey duck (*Anas superciliosa*) at Ashburton.

Other Species.

Neumann has described another species (*Ixodes intermedius*) from New Zealand, but the description is not at present available. A further species found by Professor H. B. Kirk on the tuatara will be named and described later on.

THE GRASSLANDS OF NEW ZEALAND.

PRINCIPLES OF PASTURE ESTABLISHMENT.

(Continued.)

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2. SWAMP LANDS.

Damp, fertile, alluvial Flats.

On lands of this type, if the aim is a truly permanent pasture, the general principles for the establishment of such previously outlined for good average first-class country are departed from to some extent. A mixed pasture is sown down, but all the species sown are not expected to persist as important constituents of the final sward. In other words, a transitional stage must be recognized. There are several species of grasses and clovers which do exceedingly well on damp, fertile country, such as an alluvial river-plain or drained phormium-swamp, and of these meadow-foxtail (Fig. 20) and Poa trivialis (Fig. 21) are the two outstanding species. It is not the aim, however, in the sowings to secure a permanent pasture of these grasses right from the offset. Firstly, the seed of both species is expensive, and, secondly, both plants are fairly slow to establish—two most important factors.

A mixture somewhat as follows may be sown: Perennial rye-grass, 12 lb.; cocksfoot, 10 lb.; timothy, 4 lb.; Italian rye-grass, 4 lb.; meadow-foxtail, 4 lb.*; Poa trivialis, 2 lb.*; red clover, 2 lb.; alsike, 2 lb.; white clover, 2 lb.: total, 42 lb. per acre.

In the early years of the pasture the sward will consist of the four first-mentioned grasses and the clovers, and about the fourth year there will be a decided replacement of these elements by meadow-foxtail and Poa trivialis. The rye-grasses, red clover, and alsike will go out first, but for many years the cocksfoot and timothy will persist, together with a certain amount of rye-grass and white clover. Such an association—namely, meadow-foxtail and Poa trivialis (dominant), together with cocksfoot, timothy, rye-grass, and clover—will form an excellent pasture, and one of this type is undoubtedly the highest-yielding permanent grass-pasture (with perhaps the exception of paspalum) that is ever likely to be produced.

At this point, when speaking of comparative yields of pastures, one must differentiate between truly permanent pastures, short-rotation pastures, and temporary pastures. Undoubtedly more feed could be produced, practically speaking, on all types of ploughable country by the adoption of a short-rotational system of farming, but where good high-yielding permanent pastures can be maintained the food produced is cheaper per grass-ton than that produced by the frequent ploughing and resowing necessary in short-rotational farming. Until the rent of the land becomes very high it is a sounder economic proposition to have the required food for the maintenance of the stock produced from more acres than to make fewer acres produce more by costly farm operations. Winter feed, however, must be produced, so that all the

* Only tested seed should be sown, as the germination of these seeds is frequently very low.

grass in the flush of the season may be utilized, and the team must also be kept active, else it becomes a costly burden. Consequently a certain area of the farm must be ploughed each year, but that which is ploughed and sown at a high cost per acre must be made to produce its maximum. Hence the grass-farmer on this type of country should consider the truly permanent pasture as the cheapest food for his stock (provided the rent per acre is not unduly high); but to ensure winter feed and that there should be no energy lying idle on the farm certain ploughing and resowing must be done. For many years to come, however, the permanent pasture will figure very largely on the farm on this type of country, and in the establishment and life-history of such pasture a distinct transitional stage will now be recognized.

FIG. 20. MEADOW-FOXTAIL ASSOCIATION.

A little Poa trivialis may be noted at the bottom right-hand corner.

The transition which occurs is essentially a desirable one, but it may so happen on the class of land under consideration that a more aggressive species even than meadow-foxtail and Poa trivialis may come in, and then the latter will be suppressed by their more vigorous rival. Again, the vigour of the invader may be enhanced by the fact that the herbage such plant produces is unpalatable to stock. This aids the invader in that the more palatable plants are kept down by the grazing animals, and consequently their power to resist is weakened owing to their reduced capacity to smother. An undesirable succession follows. Such an example is seen in many of these fertile

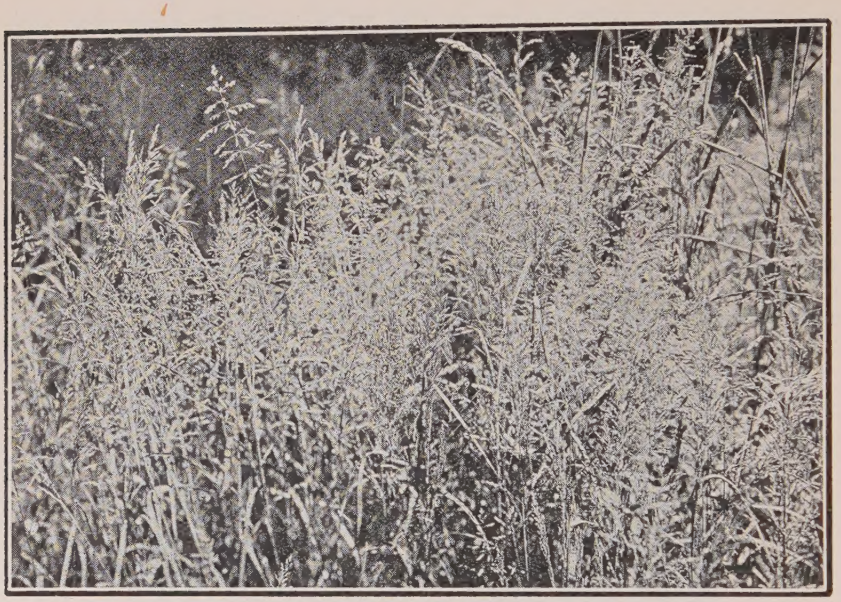

FIG. 21. POA TRIVIALIS ASSOCIATION.

FIG. 22. TALL FESCUE OCCUPYING LAND ADMIRABLY SUITED FOR PASTURE OF THE MEADOW-FOXTAIL-POA-TRIVIALIS TYPE.

lands where tall fescue (*Festuca arundinacea*) (Fig. 22) has come in and replaced the original grass association. Tall fescue is not only of low palatability, but it has as an ally a fungus disease known as ergot (*Claviceps purpurea*). Tall fescue is particularly prone to the attack of ergot, and if the stock are forced on to such pastures they are particularly liable to contract ergotism by partaking of the ergot-infested grass. Thus is it unsafe to stock heavily, and this factor makes control by stocking methods an impossibility. The avoidance of this tall-fescue succession is one of the outstanding features of grass-farming on the type of country under consideration.

Phormium ("Flax") Swamp Type.

The phormium crop as a rule represents a succession, phormium becoming the dominant vegetation, the transition being one from stunted *Phormium tenax*, raupo (*Typha angustifolia*), niggerhead (*Carex secta*), and *Mariscus ustulatus*, following on the drainage of the area. While the phormium flourishes it is without doubt the most remunerative crop that can be grown, but it frequently gives way, and particularly so of later years, where the disease known as yellow-leaf is prevalent, to a succession of Yorkshire fog, tall fescue, bracken-fern, spear-thistle, &c.

Generally speaking, good phormium areas are of first-class quality, and represent land admirably fitted for a permanent pasture of the type recommended previously for rich damp alluvial river deposits. There is, however, one feature to be guarded against—namely, that these phormium swamps are frequently not sufficiently consolidated to ensure successful permanent pasture establishment on the original breaking-up of the area. A process of consolidation must then precede the permanent-pasture sowing, and the importance of this will be made clearer when the peat-swamp lands (to be dealt with later) have been considered.

River-flood-area Type.

Certain soils are waterlogged in the winter and sufficiently dry in the summer to allow of stocking. Owing to such areas being too low-lying to drain satisfactorily, some attempt must be made to grass them with species that will tolerate wet conditions and even withstand periodic inundation for several weeks at a time. Areas near large rivers, for instance, may be inundated in the winter-time, and no amount of drainage would prevent this unless flood-gates and embankments were erected. Here, then, must be chosen grasses and clovers fitted to stand such conditions, but in this, unfortunately, the choice is limited. Of the regular plants at service timothy, meadow-foxtail, Poa trivialis, red-top, paspalum, Yorkshire fog, and Lotus major are available. Strawberry clover does exceedingly well on soils liable to be inundated by brackish water, but seed of this plant is very expensive.

A unique plant for flood-areas is sweet floating-grass (*Glyceria fluitans*). This grass will thrive only in water-saturated soils, and will stand submergence for a month or so at a time. This is possible in virtue of the plant being able to elongate its stems and to spread out its leaves on the surface of the water. Ordinary green plants with which we deal in our pastures are absolutely dependent for their existence upon a supply of air so that ordinary respiratory processes may go on. It will be obvious, therefore, that unless a plant when

FIG. 23. CATTLE-BEAST GRAZING ON SWEET FLOATING-GRASS.

The area has not been long flooded, and the water is only partially covered.

FIG. 24. SWEET FLOATING-GRASS AFTER THE WATER HAS RUN OFF.

The odd tussocks are those of tall fescue.

submerged can reach the surface of the water by elongation of its stems it will soon suffocate and die. Sweet floating-grass has this character fully developed, and the plant forms on the surface of the water a regular floating meadow. One of the quaintest of sights is to see cattle-beasts wading up to their bellies in water and eating this grass from off the surface (Fig. 23). When the flood-waters have subsided the grass takes on its ordinary ground form, and produces an enormous amount of perhaps the most palatable herbage of all our grasses (Fig. 24). Unfortunately, seed of this grass is not available at

FIG. 25. CLOSE TURF ON RICH DAMP SOIL, FORMED BY RESEEDING.

The coarser grass is cocksfoot. The finer growth is seedling crested dogstail, the parent plants having been killed out by allowing the pasture to "get away."

the present time, the little that was imported before the war having been procured from Central Europe. The plant, however, illustrates very well the character-requirements plants should possess to occupy this particular type of land.

It will be noted that on these very rich soils the tendency is for the pasture or grass cover to become more or less of a pure association. This is accounted for by the fact that the total set of characters of any one grass is capable of full development owing to the unlimited available food-supply. Any plant that possesses one character above another plant holds the advantage when the conditions are favourable to the development of that extra character. Of all our pasture-plants none are identically alike in character, consequently, on these very rich soils, when a mixture is sown that plant which possesses the additional character will finally dominate the association. On poorer land that self-same character, owing to a reduced available food-supply or to

the presence of certain physical conditions, may not be developed, and hence the grass may be just able to hold its own in a mixed association. Meadow-foxtail is an excellent example in this respect. This grass, in virtue of its short tillering rootstock, is able to spread out slowly and occupy the land. Where rich damp conditions prevail this tillering character is fully developed and the spread of this species ensured, but on soil just a little drier such character is very feebly developed. Hence meadow-foxtail rarely assumes an important position in pastures on such soils, although it may figure well as a constituent of the mixed pasture. Again, pure sowings, provided the grass is rapid to establish, are generally more permanent on these rich soils than on any other. Thus pure timothy pastures may be maintained for twenty years or more. Even short-lived species may often form a permanent sole of grass owing to the fact that reseeding can and does take place on these damp rich soils (Fig. 25). Italian rye-grass may reseed itself each year in this way, and figure permanently in the pasture. Crested dogstail forms an extremely close sole in virtue of this same attribute. Spreading by seed, however, is not common to many grasses on other types of soil, and it may be asserted as a definite fact that there is little establishment from seed unless the grass flourishes naturally on such soils. Italian rye-grass seed may fall and germinate at the first rains of autumn, but the plants remain spindly and die out as soon as dry weather arrives. In most cases the conditions are too severe for self-establishment by reseeding, but on rich damp soils establishment by reseeding is quite common.

(To be continued.)

SEED-GERMINATION AVERAGES, 1920–21.

THE average germinations of the main agricultural seeds tested by the seed branch of the Department's Biological Laboratory during the twelve months July, 1920, to June, 1921, are given below. The figures are compiled from the analyses of 10,000 commercial samples. With the exception of those marked with an asterisk the percentages may be taken as representative of good average commercial lines. In the case of those so marked the standard percentage is bracketed.

Seed.	Per Cent.
Brown-top	52
Cocksfoot	60* (65)
Cow-grass	92
Crested dogstail	80
Danthonia	43
Chewings fescue	60* (70)
Meadow-fescue	63
Fiorin	70
Meadow-foxtail	29
Paspalum	24* (35)
Poa pratensis	29* (40)
Poa trivialis	39* (50)
Red-top	82
Italian rye-grass	81
Perennial rye-grass	76
Western Wolths rye-grass	78
Timothy	87

Seed.	Per Cent.
Red clover	89
White clover	89
Alsike	84
Trefoil	70
Crimson clover	95
Lotus angustissimus (hispidus)	70
Lotus major	80
Lucerne	71* (80)
Kale	79
Mustard	90
Rape	90
Carrot	54* (70)
Swede	84
Turnip	86
Mangold	117 sprouts per 100 capsules.

—*N. R. Foy, Biological Laboratory.*

ABORTION DISEASE IN DAIRY HERDS.*

MEASURES FOR CONTROL.

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THE term "abortion disease" includes not only infection with the abortion bacillus leading to premature birth of the calf, but such sequelæ as retained afterbirth and sterility, which are frequent concomitants of the trouble.

NATURE OF THE COMPLAINT.

Abortion disease is due to infection by an organism discovered by the Danish veterinarians Bang and Stribolt in 1897. During pregnancy the specific organism reaches the womb, setting up inflammatory changes which lead to separation between the maternal and fœtal membranes. Deprived of its blood-supply, the embryo or unborn offspring dies and is expelled. This act, which is the most obvious symptom of the disease, is known as abortion. Occasionally the young animal does not die but is born alive, though usually it lacks the vigour and bodily resistance to disease of calves born from healthy stock. In such cases the inflammatory changes resulting from the womb-infection cause the fœtal membranes to adhere to the maternal attachments instead of being discharged in the normal manner, giving rise to the condition known as "retained afterbirth."

Sterility is a common sequel of abortion. It is generally brought about through infection of the womb with suppurative micro-organisms which have gained access after the act of abortion, or through putrefactive changes resulting from the retained afterbirth. The secondary infection of the womb sets up a chronic irritation, followed by the production of inflammatory fibrous tissue in the organ or its appendages, rendering fertilization of the ovum difficult and sometimes impossible.

In a minority of cases factors other than the abortion bacillus may be responsible for the accident. Those usually blamed include such conditions as cold weather, sudden change of feed or drinking ice-cold water, falls or other injuries, and pre-existing disease. Occasionally abortion may be attributed to one or other of these causes, although in the great majority of cases it proceeds from infection with the specific organism of the disease.

SYMPTOMS.

The symptoms of contagious abortion are often elusive. The event may occur at a very early date after conception, the only sign being that the cow which was believed to be pregnant has returned to the bull. Several authorities state that abortion takes place more commonly between the fifth and sixth months of pregnancy, but

* This article co-ordinates and brings up to date various matter published by the Department on the subject of abortion disease. It has been prepared with a view to reprinting in bulletin form, and will supersede Bulletin (New Series) No. 20, which is now out of stock.—EDITOR.

experience goes to show that the act frequently occurs at much longer intervals — up to the seventh and eighth months. In these late abortions valuable information may be derived from observing the appearance of the animal both before and after the accident. In advanced stages of pregnancy the infected cow may exhibit symptoms which resemble those attending normal delivery. She appears to be "springing," and "makes a bag," while the vulva is swollen, and mucus may be discharged from the vagina. If in milk, the secretion may be diminished and blood-tinged. The cow seems uneasy, and may be noticed to strain from time to time. Prior to the act of abortion and immediately afterwards a yellow discharge appears. This runs down the hind parts, soiling the tail and dropping on to the paddocks or the floors of the milking-bails. The discharge becomes thinner, and then later on thicker and greyish in colour. Retention of the afterbirth is a common event in these late cases, and furnishes strong presumptive evidence of infection by the abortion bacillus.

The appearance of the aborted calf, when discovered, is also of assistance when forming an opinion, particularly in late pregnancies. The calf may be found alive, but frequently expires shortly afterwards. It may appear to be mummified, though very seldom putrid. The discharged afterbirth appears thickened, the outer membrane being covered with a brown, chocolate-coloured deposit, while the cauliflower-like tufts studded over the surface of the exterior are sometimes soft and of a yellowish colour.

As a rule, if infection be present, more than one cow in the herd aborts, and precautions should be taken immediately to deal with suspicious cases.

FURTHER MEANS OF ASCERTAINING THE PRESENCE OF ABORTION DISEASE.

A valuable method of diagnosis now exists in the shape of the agglutination test. Agglutination is the phenomenon which occurs when blood serum from an infected animal is added to a pure culture of the infective organism. The phenomenon takes the shape of a clumping or aggregation and subsequent sedimentation of the specific bacteria — sedimentation being the naked-eye manifestation of the agglutination.

This test should only be performed in a properly equipped laboratory, but the material required—about a tablespoonful of blood from the suspected cow—is easily obtained either by a veterinarian or by the farmer himself. To secure a sample of the blood all that requires to be done is to clip away the hair on the outside of the ear, and then clean the surface with motor-spirit rubbed on with a piece of cotton-wool. A small artery and vein run down about the middle of the ear, the artery being somewhat more deeply situated than the vein. With a sharp knife make a transverse incision across the vessels, hold the ear down, and catch the blood in a perfectly clean bottle; a 1 oz. medicine-bottle answers very well. The blood, which need not exceed a tablespoonful, should be securely packed and sent to the Veterinary Laboratory, Wallaceville, where the further processes will be carried out.

The agglutination test indicates whether the animal is infected with the germs of abortion disease, but it does not prove that the cow

will abort — only that infection is present, and that precautionary measures should be taken.

MEANS BY WHICH INFECTION IS SPREAD.

Cows and heifers are liable to become infected and to abort through the following means: (1) By coming into contact with an animal which has recently aborted; (2) by swallowing food material or water contaminated with the discharge of a cow which has aborted, or by licking such discharges or similar material coming from a recently aborted cow or adhering to the aborted calf; (3) by infection conveyed by the bull either mechanically after having served a cow which is still discharging infective matter, or through the specific organisms which are discharged with the seminal fluid; (4) by infection with the droppings from infected calves; (5) through milk derived from an infected cow.

LOCATION OF THE ORGANISM IN THE BODY.

The abortion bacillus has been found in the womb during pregnancy, and in the non-pregnant womb up to two months after the act of abortion. The udder possesses a remarkable attraction for the organism, and seems to provide a natural reservoir of infection, the bacillus being able to preserve its vitality for years in this situation. When pregnancy occurs the organism is able to invade the womb from the udder, setting up the inflammatory changes which result in abortion. It does not apparently injuriously affect the udder, and when present gives rise to no appreciable disturbance of the gland or its functions.

Following the act of abortion the womb rapidly cleanses itself of infection. The abortion bacillus will not live for long in the empty womb. On the other hand, it appears able to exist indefinitely in the udder.

PREVENTION AND TREATMENT.

It is possible to build up a herd free from abortion disease, provided the owner is willing to go to the necessary trouble and expense involved. Where the occurrence of infection is small the following measures are suggested: The herd is divided into two classes—(1) Those known to be infected; (2) those which are known to be free from the disease. This knowledge is arrived at by means of the agglutination test applied to all animals in the herd. The two classes must be kept separate. The clean herd is periodically tested, and all reactors transferred to the infected class. All animals of the infected class are brought in as soon as signs of "springing" are noticed. They must not be allowed to calve in the paddock. A special enclosure or loose-box should be provided wherein the cow may calve. All discharge before and immediately after the act must be washed down with disinfectant, and the afterbirth cleared away and burned. After delivery the cow must be douched with disinfectant solution, and this treatment continued daily until all signs of discharge have ceased. Service should not take place until the cow appears perfectly normal in this respect. Animals of the infected class should not be considered clean until they have failed to react to the agglutination test applied twice at intervals of six weeks. Heifer calves bred from the infected cows should be

retained with the object of building up an immune herd, since it is known that these possess a tolerance to the disease.

In case these measures should be impracticable, individual treatment of animals which abort will have to be undertaken. The aborted calf and all membranes and discharges must be sought for and burned. The cow must be separated from the rest, and receive daily irrigations with disinfectants. It does not matter much which of the well-known antiseptics is employed for this purpose, provided that they do not produce excessive irritation and straining. If the douche is found to cause the animal inconvenience or to inflame the mucous lining of the vagina it must be used in weaker solutions. Probably a solution of permanganate of potash or Condy's Fluid is as cheap and effective as any. To prepare the solution half a teaspoonful of the permanganate crystals or three tablespoonfuls of Condy's Fluid should be dissolved in 1 gallon of boiled water.* The solution should be injected at blood-heat. In order to carry out the irrigation it is necessary to provide a 3 ft. length of indiarubber tubing of ½ in. diameter, and a small glass or enamelled funnel. Also, for use with the bull, an ordinary enema syringe with vulcanite fittings should be obtained. This treatment should be applied as early as possible after abortion has taken place, and before the mouth of the womb has had time to close.

Method of Procedure in treating Cows.

(1.) Boil for five minutes the tube with the funnel inserted into one end, then lubricate the outside of the tube with olive-oil or vaseline. (2.) Wash the hands and arms thoroughly in hot water to which a disinfectant has been added. (3.) In the case of a newly aborted cow pass the free end of the piping gently into the womb, taking care not to injure the lining membrane. During insertion the curve of the tubing is better turned downwards. (4.) Hold the outer end of the tubing with the funnel about 6 in. above the root of the cow's tail. (5.) Pour the solution gently into the funnel, and irrigate the womb thoroughly. (6.) Thoroughly wash down the parts from the root of the tail to the bottom of the udder, and also the under-side of the tail, with a 2-per-cent. lysol solution. (7.) If the cow is rugged cleanse the hinder border of the cover, and also the straps attached to it, with the lysol solution.

Method of Procedure in treating a Bull.

Place the animal in a crush-pen, or otherwise secure him in such a manner that he may be handled without danger. First clip away the long hair from the opening of the sheath, then with the enema syringe disinfect the penis and sheath with the permanganate-of-potash solution injected warm. During the operation the sheath should be held partially closed with the hand in order to prevent the too rapid escape of the solution. The belly and thighs should be well sponged down with a 2-per-cent. solution of lysol. This process should be carried out immediately before and after service.

* The correct strength of this solution can soon be learned by observation; it should be of a bright-purple hue.

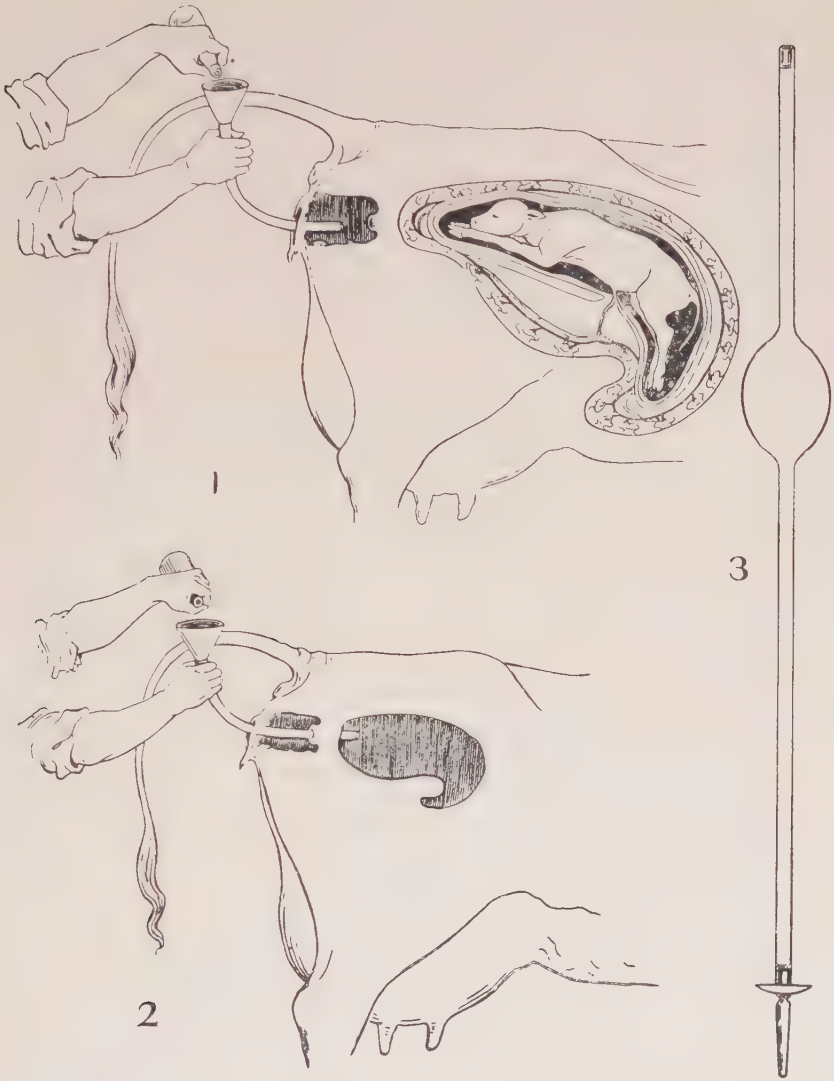

FIG. 1. METHOD OF IRRIGATING VAGINA OF COW AS A PREVENTIVE OF ABORTION. FIG. 2. METHOD OF IRRIGATING WOMB OF COW WHICH HAS ABORTED. FIG. 3. ENEMA SYRINGE FOR IRRIGATING SHEATH OF BULL. *[Diagrams by H. C. Wilkie.*

Since the bull may be systemically infected and convey the disease in the seminal fluid it is advisable to have a blood test performed to ascertain whether he is free from disease.

DISINFECTION OF PREMISES.

Cleanliness in everything connected with the operation of milking is most important. The milking-sheds and utensils should be cleaned down as soon as milking is finished, and where disease is known or

suspected to exist the shed and yards should be douched or syringed with disinfectant. For this purpose sulphate of copper (bluestone) in 4-per-cent. solution (approximately 5 oz. to 1 gallon of water) is a cheap and reliable agent; but thorough cleanliness must precede any effort at disinfection.

The dead calf and membranes from the aborted cow should be collected and burned on the spot, using kerosene if necessary to ensure complete destruction. The ground contaminated by such discharges should be dug up and saturated with a solution of some non-poisonous sheep-dip or the bluestone solution.

Attendants should wear washable garments, and should wash the hands and arms in disinfectant to free them from all material likely to convey infection.

VACCINE TREATMENT.

Treatment of abortion disease by internal medication may be dismissed as entirely unreliable and without any scientific foundation. Preventive treatment by vaccine may offer some advantages when used among badly infected herds.

The vaccine consists of living cultures of the abortion bacillus, which are inoculated under the skin of non-pregnant animals two months before service. Opinions differ as to the actual value of vaccination as a measure of control. The disadvantages of the system as applied to conditions existing in this country are the necessity of making certain that the animals it is proposed to inoculate are non-pregnant, and the length of time which must elapse before service can be effected. A serious drawback, also, is the fact that, as living cultures have to be employed, the inoculated cattle are converted into "carriers" of the disease for an indefinite period. These limitations render the system unsuitable for use in clean or only slightly infected herds, though where the disease is well established greater latitude may be permissible.

HERD-MANAGEMENT.

Not the least important part of the control of abortion disease is the intelligent management of the herd. Having regard to the facts that the incidence of abortion has a tendency to decline, and that immunity or tolerance becomes established in cows which have aborted, it is unwise to dispose of these animals except for slaughter. By sending them to the saleyard the disease is liable to be spread, while buying in fresh cows may mean the introduction of a susceptible animal into infected surroundings. Calves bred in infected surroundings also acquire a tolerance to the disease. It should be the aim, therefore, of the owner of infected cows to endeavour to build up a herd of his own breeding.

Cows about to calve, either normally or when showing signs of impending abortion, should be brought into an enclosure where they can be kept under observation and the necessary measures observed should abortion take place. Such precautions will avoid the scattering of infective material over the paddocks, which will occur if the animal be left at large. If it becomes necessary to buy in fresh stock care should be taken to ascertain if possible the antecedents of the animal,

and not to introduce her immediately into the herd. In such cases a blood test will determine whether she is free from infection. Where possible a breeding-bull should be maintained, but when a loaned bull has to be used precautions should be taken, and the animal treated in accordance with the advice already given.

When infected animals are isolated a suit of overalls and gum boots should be donned when going among or treating them. These must be removed, and the hands and arms washed in disinfectant, before handling healthy stock.

Unpasteurized separator milk from local factories may contain the organism of abortion, and ought not to be brought on to clean premises.

RETENTION OF THE AFTERBIRTH.

The frequency of this complication following abortion renders it necessary to offer advice regarding it. It is unwise to be in too great a hurry to remove the retained cleansing, except in those instances where symptoms of septic inflammation of the womb are evident, when the membranes should be extracted as soon as possible, the womb having been well flushed with antiseptic beforehand. If extraction by hand has to be resorted to it is always more difficult and less successful when attempted too early, and provided the general health of the animal is maintained there is no necessity to do so. The best course is to irrigate twice daily with warm permanganate-of-potash solution (half a teaspoonful of the crystals to the gallon), and, if the membranes are still retained, not to attempt to remove them earlier than the third or fourth day. If possible, the services of a veterinarian should be requisitioned, for the process may not be easy, and its accomplishment may require expert knowledge of the anatomy of the parts involved. Manual extraction is a thing to avoid if possible.

STERILITY AND DIFFICULTY IN GETTING IN CALF.

These conditions very frequently arise as a result of infection with abortion disease, though in a few instances other factors may be responsible. The damage to the womb and appendages created by the chronic inflammatory disease set up by infection with the abortion organism assists other organisms to establish themselves in the mucous lining of the generative canal. This leads to a catarrhal condition, followed by the formation of fibrous tissue in the parts, which thereafter become partially or completely functionless. Such conditions are difficult to treat, and the results are often disappointing. The aim must be to enable the bodily defences to overcome the invading organisms, and to this end we must provide every assistance. Chief among these measures must be the maintenance of the animal in good general health and condition by the provision of suitable food and water supply and good well-sheltered paddock accommodation.

It is not by washing out with strong disinfectants, which further injure the delicate mucous lining of the passages, that success may be achieved, but in relieving the organs as far as possible of the accumulated inflammatory products, and stimulating the body-cells to further activity. The average farmer cannot be expected to be able to carry out certain stages in the necessary treatment. In some instances the mouth of the womb is firmly closed, and before anything can be

introduced into it the passage must be dilated. In dealing with these chronic inflammatory conditions of the generative organs iodine has proved of great value. It is usually employed in the form of Lugol's solution, which consists of iodine 5 parts, potassium iodide 10 parts, and boiled water 100 parts. When veterinary assistance is procurable the solution may be used to dilate the closed entrance to the womb, which in the course of two or three days can generally be made to relax sufficiently to permit the entrance of a catheter. The womb is then flushed out with a solution of Lugol's solution, 2 parts in 100 parts of water, followed by a douche of warm salt-solution (1 oz. salt to 1 gallon water). The object of this treatment is to stimulate and increase the blood-supply to the parts, and to lower the vitality of the invading organisms.

Where treatment of this nature cannot be carried out recourse must be had to antiseptic injections. The vaginal passage should be washed out with a warm solution of permanganate of potash a day or two before the cow is expected to come in season, and the passage may be flushed with a solution of bicarbonate of soda (5 oz. to ½ gallon of warm water) about half an hour before service. This simple expedient has sometimes been followed by success, the cow becoming pregnant. In more advanced cases of disease of the womb, however, veterinary aid will, as a rule, have to be obtained.

Casein-manufacture.—This subject is dealt with as follows in the annual report of the Dairy Division for 1920–21: "The increase in the production of butter was accompanied as a consequence by an increase in skim-milk. There was a greater inclination to convert the latter into casein, and the output of this product showed a very considerable increase, the export at 1,760 tons denoting an increase of some 75 per cent. Both lactic and rennet casein were manufactured, a large proportion of the latter being produced toward the end of the season. This variety improved somewhat in quality this season, but it is considered there is still a good deal of room for improvement before the New Zealand article attains to the degree of excellence maintained by French rennet casein, which supplies the highest class at a price higher than will be paid for our average quality. New Zealand rennet casein is considered to contain too much butterfat. This may be minimized by cleaner skimming. It has been shown during the past season that some separators were not doing their work with the desired efficiency, which means not only lower-quality casein but also a loss to the buttermaking department as well. It is considered that New Zealand has many advantages relative to casein-production as compared with competitors, and that, as the use of casein is likely to extend, the further development of the industry is a reasonable expectation."

Swamp-land Development.—It has been well demonstrated at the Ruakura Farm of Instruction that when once grasses and clovers have been successfully established on swamp land of that type it is not good practice to break up the ground again for years to come with the object of cropping. This was clearly demonstrated in two instances, and on no small scale, during the past year. Field 35 (14 acres) and field 38 (16 acres), after having been in grass for five years, immediately reverted to sorrel when ploughed and worked up again for cropping.

Official Seed-testing.—During the last official year 8,800 samples were tested for purity and germination by the seed-testing branch of the Department's Biology Section. This is the largest number hitherto dealt with in any one year. The maximum capacity of the present seed-testing equipment is about ten thousand samples per year.

A FUNGUS DISEASE ATTACKING BLACKBERRY.

IDENTIFIED AS RASPBERRY CANE-WILT.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

PROBABLY the most serious fungus disease that raspberry-growers have had to contend with in New Zealand is that known as "cane-wilt." During last season numerous specimens of blackberry-canes apparently infected with the same disease were sent to this Laboratory from various parts of the North Island. At the same time many statements appeared in northern newspapers to the effect that large areas of blackberries were being killed outright. Opinions were divided as to the cause of the death of these plants, one theory being that fire-blight had spread from hawthorn to the blackberries. Interest became so widespread in this supposed new disease, credited with exterminating one of the most troublesome of noxious weeds, that the writer was directed in May last to visit the localities where the outbreak had been reported as being most severe, in order to investigate the nature of the causative organism, and, if possible, to ascertain the extent of the damage done and the probable value of the organism as a controllant of blackberry.

At Hamilton I was joined by Mr. L. Paynter, Orchard Instructor for the district, and we proceeded via Rotorua to Ngawaro and Oropi, where the disease had been reported as doing considerable damage. At Ngawaro we were informed that the most serious infection in that locality had been seen in plants immediately across the road from the post-office. Our informant assured us that the infection in that year had been slight, but that in the previous season some dozen or more plants had had many of their canes killed back to about ground-level. Inspection showed that these plants appeared to have made normal growth during the current season, but the fact that they had been severly attacked the previous year was evident from the presence of numerous dead canes. That the current season's infection was slight was evident from the fact that out of half an acre or so perhaps a dozen plants in all were attacked, and these chiefly on the fruiting-panicles, a feature which is discussed later in some detail.

At Oropi it had been reported that a large area of blackberry had been severely attacked by this disease, this area being situated in a bush-clearing about half a mile from the main road. Here the infection, although slight, was more general, as an area of perhaps half an acre had the greater number of plants in it more or less severely attacked. In some cases two or three of the canes were seen to have been killed back for about half their length, but generally cane-infection was slight, the disease being confined to the branches of the panicles, which, together with the maturing fruits, were often killed outright.

From Oropi we proceeded to Tauranga, thence to Waihi, Te Aroha, and Morrinsville, and back to Hamilton. Throughout these districts odd infected plants were noticed by the roadside, in all cases panicle-infection being common, while cane-infection was slight or absent.

Specimens forwarded to this Laboratory from Auckland, Gisborne, Napier, and Hastings all show the same diseased condition of the panicles, indicating that the disease is widely distributed in northern parts of the North Island.

THE CAUSATIVE ORGANISM.

Many specimens were gathered on the trip and brought back to the Laboratory, where they were microscopically examined. Although numerous fungi were present on older canes that had been killed in the previous year, study of these showed them to be all saprophytes. However, Mr. Paynter continued to forward specimens, and before long the fruiting-stages of the causative organism were obtained. The fungus concerned proved to be the same as one which had some time previously been isolated from diseased raspberry-canes sent in from Motueka—namely, *Leptosphaeria Coniothyrium* (Fcl.) Sacc., causing cane-wilt disease.

This fungus belongs to the Ascomycetes, and possesses two stages in its life-cycle. The first or conidial stage, which has been named *Coniothyrium Fuckelii* Sacc., is the actively parasitic one, and the killing of canes is due to this. It consists of a simple flask-shaped receptacle (pycnidium) in which very many minute olive-coloured elliptical spores are produced. If one of these spores alights on any portion of a raspberry or blackberry plant, providing conditions are favourable, it germinates, producing a fine thread (germ-tube) which penetrates the epidermis. Once inside the tissues of the host this thread divides repeatedly, and quickly gives rise to a mass of threads (hyphæ) which ramify in all directions.

Later in the season the perfect (ascigerous) stage of the fungus appears. Little is known as to what part the perfect stage plays in the reproduction of this fungus, but from a knowledge of the behaviour of certain other related fungi it is probable that this ascus stage is the resting-stage, and is capable of remaining viable for a considerable time, probably for three or four years. The perfect stage consists of a flask-shaped receptacle in which is borne a number of colourless sacs (asci), each containing eight four-celled ascospores. On germination an ascospore produces hyphæ, which behave in a similar manner to conidial hyphæ, giving rise in turn to pycnidia. Generally conidia are produced only during the growing season, the ascigerous stage appearing only after the death of the plant or part of plant attacked.

EFFECT OF THE FUNGUS ON ITS HOSTS.

As the behaviour of this fungus varies somewhat according to the host attacked, raspberry and blackberry infection will be dealt with separately.

Raspberry (*Rubus Idaeus* L.): Infection is more severe on this host than on blackberry. It is as a rule confined to fruiting-canes, but occurs also on young growing shoots, and, rarely, on fruiting-laterals (panicles). On canes, the first appearance of the disease is marked by the leaves becoming reddish-brown in colour. This condition is rapidly followed by the wilting of portion or all of the canes. This wilting is due to the cutting-off of the water-supply owing to the presence of

masses of the fungous hyphæ, which have penetrated to the conduction vessels (phlœm and xylem) and there grown so rapidly as to completely block them up. It is thus seen that if the cane is attacked at or near its base the whole dies, whereas if infection were to occur near the apex of the cane only those parts above the point of attack would die, the portions below remaining quite healthy and maturing their fruit. Young growing shoots are killed outright, so that where infection is severe not only the present crop but the succeeding year's crop may be almost entirely destroyed.

Blackberry (*Rubus fruticosus* L.): On the whole, blackberries are much less severely infected than are raspberries. Panicle-infection is by far the commonest stage, cane and leaf infection as a rule being slight. On canes, infection is not followed by sudden wilting, but where it has been severe, cankers appear which so weaken the cane that it gradually dies. The first appearance of the fungus on canes is made noticeable by the presence of minute white blisters. These are formed by the epidermis being separated from the tissues below on account of the dissolution of the latter by the hyphæ of the fungus. These blisters gradually increase in size and coalesce, the epidermis finally falling away, leaving minute irregular cankers in which may be seen the fruiting bodies of the fungus.

Flower and fruit infection is the common stage on blackberry, resulting in the nearly mature fruits, their pedicels, and the main axis of the panicle being killed back to the cane. Further than this the fungus rarely penetrates. This stage becomes very conspicuous where attack has been severe, as the whole panicle, including the fruits, turns a pale-chestnut colour. Infection may occur in the fruits themselves, in which case the hyphæ ramify between and send branches into the drupelets, which are soon drained of their contents. The fungus then works down the pedicel and up into other fruits, or else by attacking the lower portion of the peduncle may cause the death of most of the fruits by cutting off the water and food supplies. The fact of this organism being the cause of the death of the panicles is often obscured by the presence of numerous saprophytic fungi which make their appearance on the dead fruits. Of these the most common is a species of *Rhizopus*, which forms a dense black mould over the whole surface of the fruit.

Leaf-infection, which is slight both on raspberries and blackberries, results in minute dead areas being formed, which fall away, leaving small perforations.

It is noticeable in the field that certain varieties of blackberry are more susceptible to attack than others. For example, one of the most common varieties in the North is a small semi-prostrate profusely fruiting one; wherever this plant occurs in an infected area it is invariably badly attacked. A much less common variety is somewhat erect, large-leaved, vigorous-growing, and shy-fruiting; this plant is usually free from all traces of the fungus. Infection in all degrees of severity may thus be seen in the field. Observations lead one to believe that this is due to the paucity or abundance of fruits, as invariably profuse-fruiting varieties are small and stunted in their growth, and suffer much more severely than the strong-growing, vigorous, shy-fruiting varieties.

CONTROL MEASURES.

As regards raspberries, American experience has shown that spraying for cane-wilt is of little avail. As the receptacles from which the spores are produced are buried in the tissues, they are unaffected by any application of a spray mixture. Moreover, as spores are produced throughout the season repeated applications would be necessary to prevent spore infection. The disease being spread from fructifications embedded in drying canes, or canes which may have been dead for two or three seasons, it is obvious that control measures should lie rather in the removal of all infected canes so as to prevent spore-distribution. Therefore on the disease making its appearance all dead canes, whether newly killed or otherwise, should be removed and burned. Where possible, the whole infected plant, including the roots, should be destroyed.

Regarding the use of this fungus in the control of blackberry, when it first made its appearance on blackberries it was thought by many persons that the disease would exterminate this weed. Numbers of specimens were forwarded to this Laboratory with requests for information as to what had killed them and whether the organism could be used as a controllant. It will become evident to any one reading the above notes that the fungus is much more severe on raspberries than on blackberries. In fact, although many hundreds of infected blackberry-plants were observed on the trip referred to, not one was seen to have been killed outright. Where infection is severe practically all fruiting is prevented by the killing of the panicles, but cane-injury is so seldom seen as to render this phase of the disease entirely negligible.

CONCLUSION.

From the foregoing it would appear that although the *Leptosphaeria Coniothyrium* fungus is the cause of heavy loss in certain seasons to raspberry-growers it causes little or no real damage to blackberry-plants, though, where infection is severe, fruiting on certain varieties may be entirely prevented. The probability therefore is that if the fungus were introduced into any locality with the object of exterminating blackberry it would do little or no damage to the latter, but would spread to a host more favourable to its full development, such as raspberry, should this plant be growing in the neighbourhood. Furthermore, there is always the danger of its spreading to hosts other than the two under discussion. In America it has been recorded on roses and apples, and in Europe on a large number of hosts, among which may be mentioned barberry, elderberry, and willow.

Mountain Grassland Top-dressing.—Recent experiments in Switzerland on the top-dressing of mountain meadows and grazing-land with commercial fertilizers show that not only was the yield and plant-composition of the pasture greatly improved, but also its quality. In a case cited chemical analysis of the fodder gave the following percentages of crude protein: No manure, 10·9; superphosphate, 17; superphosphate and potash salt, 15·1; superphosphate and liquid manure, 12 per cent.

Noxious Weeds.—Recent declarations under the Noxious Weeds Act by local bodies comprise the following: Cook County, Waikohu County, Waihi Borough, and Birkenhead Borough—Hawthorn; Clifton County—Barberry; Featherston Borough—Gorse, broom, hemlock, and fennel.

YELLOW-LEAF DISEASE IN PHORMIUM TENAX.

PRELIMINARY REPORT ON A CURRENT INVESTIGATION.

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INTRODUCTION.

WHERE the disease under consideration is rife and the foliage of many acres is abundantly yellowed the commonly adopted name of "yellow-leaf" is truly descriptive of the general appearance. It is not especially the shade of yellow nor any other specific quality that has led to the adoption of this term, but rather the predominance or generality of the colour over areas where the disease is bad. We have shown, however, that lack of water or even an excess of it may be followed by yellowing in phormium-leaves, as also may too little light. The yellowing of the foliage, therefore, like pain in the human body, is a very general symptom, and one that may arise from a variety of causes. Nor yet does the order in which the leaves discolour constitute a distinctive feature of yellow-leaf, for the same order is maintained when yellowing is produced by various means.

That certain large areas of phormium have yellowed and died rapidly there is no doubt, and that such yellowing differs, at least in its rapidity, from what is usual in healthy flax is equally apparent; yet as a symptom of the disease—at one time the only known symptom—the yellowing of the leaves was found to be a character of little or no value for the purposes of specific identification. When, therefore, it was asked, "What is the cause of yellow-leaf?" one was forced to inquire, "What specifically is the disease referred to?" And it became clear that until a more definite idea could be formed as to the symptoms distinguishing "yellow-leaf" from various other yellowing processes little advance could be made towards arriving at the specific cause of the disease. In this particular disease, therefore, the symptomatology presents as much difficulty as the etiology.

FUNGUS IN THE ROOTS.

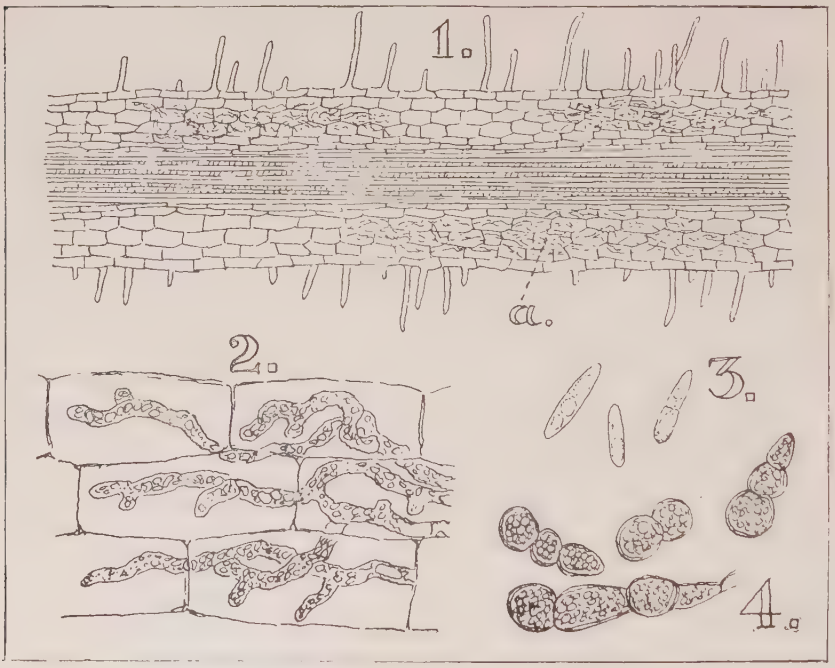
Our first problem, therefore, was further to define the disease by associating it with other symptoms more distinctive than the single one that we had—namely, the orange-yellowing of the foliage, starting with the outermost leaves and progressing inwards towards the centre of the fan, successively discolouring such leaves often at a rate greater than that at which they can be replaced at the centre.

It is a very obvious fact that badly affected bushes are remarkably easily uprooted, and that the reason for this is the rotting of certain of the roots. In studying the pathology of yellow-leaf one is therefore led at once to observe the coarse microscopic fungus in the tissues of the roots, more especially in the finer roots. This would certainly constitute a very distinctive symptom if it proved to be causative. In the attempt to prove or disprove the connection of this fungus with the disease the following facts have been ascertained:—

(1.) A large number of microscopic sections prepared by Mr. G. H. Cunningham, of this Laboratory, showed that there was no trace of the fungus in the seed.

(2.) No trace of fungus was found in the roots of eleven-month-old seedlings raised from corrosive-sublimate-sterilized seeds in sterilized river-sand. These two first observations indicate that the fungus is not present *in* the tissues of the seed.

(3.) No trace of the fungus was found in the roots of eleven-month seedlings raised from *unsterilized* seeds in sterilized river-sand. This would indicate that the fungus is not in general carried over upon the *exterior* of the seed.



FUNGUS IN ROOTS OF PHORMIUM.

1. Section of rootlet showing (*a*) position of fungus stands. 2. Portion of a rootlet section more highly magnified, showing the fungus within the cells and its coarse and granulated character. 3. Conidiospores of Ramularia. 4. Chlamydospores of Ramularia.

(4.) The coarse vacuolated fungus-strands were, however, found abundantly in the root-tissues of seedlings of the same age raised from the same collection of seed, but sown in soil from a flax-swamp where yellow-leaf was abundant. This indicates that the fungus is maintained in the soil, whence it invades the roots of flax.

(5.) The fungus was found in the roots of year-old seedlings raised in soil from a swamp free of yellow-leaf disease, in nine-month seedlings raised in Wellington garden soil, and in nine-month seedlings nursery-raised. This shows that the fungus is present in various soils, and not exclusively where yellow-leaf disease is met with.

(6.) Typical coarse fungus-strands are common in the roots of adult yellow-leaved phormium, but they are equally common in the roots of bushes showing no signs of this disease.

(7.) Such strands have been observed in roots taken from isolated phormium patches apparently perfectly free of the disease and miles distant from any affected phormium.

(8.) The fungus is commonly found in the roots of *Phormium Colensoi* as well as *P. tenax*.

(9.) Fungus-strands in phormium-roots have been found in material from Dunedin, Seatoun, Kelburn, Karori, Plimmerton, Waikanae, Levin, Shannon, Makerua, Tokomaru, and Paparoa, the latter place eighty-five miles north of Auckland. Thus the fungus is found in healthy and diseased bushes alike, in both phormium species, and is widely distributed throughout New Zealand.

(10.) The fruit (chlamydospores) of the fungus was rarely observed in the root-tissues.

(11.) The fungus has been isolated from phormium-roots and successfully grown on artificial culture media.

(12.) It has fruited freely (producing both chlamydospores and conidiospores) on artificial culture media.

(13.) Pure cultures sent to Kew Botanic Gardens, England, were identified as a species of *Ramularia*.

(14.) Certain *Ramularia* species are already recorded as parasitic on the leaves, stems, and roots of plants other than phormium.

(15.) Pure cultures have been inoculated into the roots of healthy phormium seedlings, and in several cases lesions were found about the point of inoculation.

(16.) Typical yellow-leaf, however, has not yet made its appearance *in the foliage* of any of the inoculated plants. Thus Koch's postulates have not been fulfilled. We have certainly been obliged to modify our views with regard to *Ramularia*. We hold that it is a saprophyte and a parasite. Its parasitism is frequently not markedly destructive —it may never be—but there is a possibility that under some conditions it is. While, therefore, the presence of this fungus may not be regarded as a symptom of yellow-leaf, there is still the possibility that suitable conditions may serve to convert it into a parasite more destructive than it appeared in the roots of inoculated plants, and sufficiently destructive to result in the yellowing of the leaves. Experiments are now in progress to show any relative parasitism that may be exhibited by the fungus under various environmental conditions.

TESTS FOR MICRO-ORGANISMS GENERALLY.

Seeing that the *Ramularia* inoculations might take many months to demonstrate pathogenicity, it was decided in the interim to set out on an entirely different course. Reviewing the whole position it was clear that none of the previous investigators of this disease had put forward any incontrovertible or even convincing evidence that yellow-leaf was caused by some micro-organism, nor were we in a position to assert that it was. It appeared that a series of carefully devised experiments might reasonably be expected to yield some facts as to whether the disease was due to a living organism or an association of organisms. We shall not attempt more than briefly to sketch the main lines that were pursued with this purpose in view.

In these experiments it was necessary to raise a large number of seedlings; the commercial seed available was found to be quite worthless. Some useful data were secured concerning the saving of phormium-seed and the propagation of seedlings, a matter in which there has been some difficulty in oversea countries desirous of establishing the plant. The following experiments were then established in duplicate or triplicate:—

First Series.

(1.) Seed collected from what appeared to be yellow-leaf "resistant plants" was sown in phormium-swamp soil where no yellow-leaf could be found (hereafter referred to as "uninfected bog soil").

(2.) Seed collected from yellow-leaf plants (temporarily regarded as "susceptible seed") was likewise sown in uninfected bog soil.

NOTE.—It should here be recorded that in the flowering and seeding time one of the most distinctive and constant symptoms associated with the yellow-leaf condition was found to be the failure of the affected plant to put up a flower-stalk; even if it managed to do so the stalk was frequently stunted, and was rarely able to bring more than a few seeds to maturity.

(3.) Resistant and susceptible seed sown in alternate rows in uninfected bog soil.

(4.) Resistant seed sown in soil collected from beneath a number of badly yellow-leaved plants ("naturally infected bog soil").

(5.) Susceptible seed sown in naturally infected bog soil.

(6.) Resistant and susceptible seed sown in alternate rows in naturally infected bog soil.

This series of experiments aimed at showing whether or not the infecting agent was to be sought in the soil, and, if so, whether there was any relative resistance or immunity in the seeds. The seed was sown in boxes at two different times of the year, so that very delicate roots would be available to any infecting agent for a long time and under considerably varying ranges of temperature and humidity.

Second Series.

(1.) Phormium seedlings (a little under twelve months old) planted in pots of river-sand sterilized at 160° C. for two hours.

(2.) Phormium seedlings planted in sterilized river-sand which was subsequently inoculated with *Ramularia*.

(3.) Phormium seedlings planted in naturally infected bog soil.

This series aimed at showing various points, amongst which were—(*a*) Whether the infecting agent was a micro-organism associated with the seed: (*b*) whether it was *Ramularia*: (*c*) whether it was contained in the soil.

Third Series.

(1.) Phormium seedlings planted in pots of garden soil (referred to as "uninfected garden soil").

(2.) Phormium seedlings planted in uninfected garden soil in which was buried diseased roots collected from typically yellow-leaved bushes.

(3.) Phormium seedlings planted in naturally infected bog soil.

(4.) Phormium seedlings planted in uninfected garden soil subsequently inoculated with *Ramularia*.

This series was an attempt to show whether the infecting agent was to be sought in the diseased roots of typically yellow-leaved phormium, whether it was located in the soil, and whether it was *Ramularia*.

Results.

These three series were instituted nearly twelve months ago. Unlike positive results, negative ones are by nature somewhat inconclusive. Such are the results obtained from these experiments to date. The following are some of the *possible interpretations* of these results :—

(1.) Seeing that no trace of the yellow-leaf condition has yet appeared above ground in any of the three series, the micro-organism if such be the cause would appear very exacting in its environmental requirements or but a weakly parasite.

(2.) Or such micro-organism may not have found in the conditions provided in the experiments such an environment as would enable it to assume destructive parasitism. (Other experiments have since been instituted to secure more light upon requisite environmental conditions.)

(3.) Again, seeing that *Ramularia* is so widely distributed throughout New Zealand and that it failed to result in the yellowing of these seedlings, the indications are that it is not causative.

(4.) On the same lines the lack of positive results in all three series gives us no reason to believe that yellow-leaf is caused by any micro-organism whatever ; but, while these experiments are fairly extensive ones, it would at present be quite unsafe to accept this negative evidence as fact. There is much work to be done before such a conclusion should be entertained.

RELATION OF INDIVIDUAL ROOTS TO INDIVIDUAL LEAVES.

The suggestions were made that the death of the older roots was resulting in the yellowing of the older leaves ; that the trouble might be physiological ; and that the disease might consist largely in a mere acceleration of what normally took place. This led to the following experiment to prove whether or not certain roots fed certain leaves : Certain main roots were cut and were instantly fed with coloured water. Red, which was supplied through only one root, made its appearance in the vascular system of nearly every leaf of the fan. The colour green simultaneously fed through another single root appeared in many leaves, and, moreover, in some of those into which red had also made its way from an entirely different root. This experiment shows that individual roots serve many leaves. Other experiments have shown that damage from adverse conditions of various kinds commonly is shown in the outer leaves first. A deficiency of functioning roots, as in transplanting, results in the death of the outermost leaves.

BACTERIA IN RELATION TO YELLOW-LEAF.

A bacteriological study was then commenced of the finer roots which on affected phormium were very commonly seen to be discoloured and rotting. Six different organisms were isolated ; they were immediately grown separately in quantity, and then were mixed and applied to pots of phormium seedlings to see whether one or an association of them could set up the disease. The pots were incubated at 25° C. for twenty-four hours, thereafter kept in the laboratory a few days, and finally sunk in the ground outside. In twelve months the seedlings have shown no signs of disease above ground. Other organisms, both bacteria and fungi, have from time to time been similarly tested, but with negative results.

RHIZOME-CANKER.

Some time ago it was noted that parts of the vascular system of the rhizome of affected phormium occasionally showed discoloration, and some of our later expeditions to the swamps were devoted mainly to this matter. A considerable amount of material was dug up and sectioned on the spot, the result being the discovery of a cankerous condition of the rhizome associated very commonly indeed with plants in the advanced stages of yellow-leaf. The flora of this canker is now being studied. A short round-ended diplo-bacillus has been isolated and inoculated into phormium seedlings. The inoculated plants have been subjected to saturated soil conditions and relatively high temperatures such as occur in the swamps. A number of phormium seedlings have, moreover, been recently planted out in a swamp in places where the disease is rife. Again, cylindrical plugs from the cankered rhizomes of yellow-leaved bushes have been cut out with a cork-borer, and have been inserted into holes made in the rhizomes of a healthy phormium plant, suitable controls being set up. It is, however, too early to expect any results from this work.

CONCLUSION.

In concluding these notes we would like to make plain the following points: It should be clearly recognized that while every endeavour is being made to trace the cause of yellow-leaf disease to a specific organism, nevertheless in the light of our present knowledge it cannot be assumed that a micro-organism is certainly the cause. Even if the trouble is finally traced to a specific organism the present evidence would show that only under precise conditions does it exhibit destructive parasitism. We would therefore stress the study of requisite environmental conditions; it may ultimately prove more productive of control measures than a knowledge of the causal agent.

TREE-SHELTER FOR COASTAL DISTRICTS.

THE species of trees best suited for growing on the sea-front and in New Zealand coastal districts generally are as follows:—

Pinus pinaster (maritime pine) is the most suitable for the front row next the sea. It withstands saline winds and will grow in pure sand.

Pinus muricata, *Pinus thunbergii*, and *Pinus densiflora* come next in order of merit. They are actually better shelter-trees than the maritime pine, but are slightly more susceptible to saline winds than that species. All three grow well in sand.

Pinus radiata (*insignis*) and *Cupressus macrocarpa* suffer to a very considerable extent if subjected to strong saline winds. They are, however, of greater economic importance than any of the species previously mentioned. Both grow fairly well in sand, provided it has some organic matter mixed with it.

Shelter in coastal districts can be most effectively secured by planting the trees in wide belts—say, one chain wide. A single row of trees or even a narrow belt is of very doubtful value, especially on the west coast, where strong saline winds are prevalent. The first rows on the windward side should be composed of *Pinus pinaster;* behind these a few rows of *Pinus muricata*, or the other species grouped with it, should be planted. With the shelter afforded by these trees *Pinus radiata* or *Cupressus macrocarpa* may be successfully grown. A spacing-distance of 4 ft. by 4 ft. should be adopted for the first shelter-lines, 6 ft. by 6 ft. for *Pinus radiata*, and 4 ft. by 4 ft. for *Cupressus macrocarpa*.

—*State Forest Service.*

EXPERIMENTS WITH "RADIO" MANURE.

SECOND YEAR'S RESULTS.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

In the March, 1921, issue of the *Journal* was published an article on tests with "Radio" manure used with autumn-sown grass and as a top-dressing for permanent pasture. The report gave the results of trials covering one season, and indicated that coaldust—which makes up 60 per cent. of the weight of Radio manure—had a depressing effect on the grasses and clovers, lowering the crop-yields in every case. With further results now to hand after another year's observation, and, in addition, the weights of hay and green-stuff respectively obtained from top-dressed pasture and grass plots laid down with the object of testing Radio, fresh evidence is furnished upon which to base conclusions regarding this fertilizer.

The average returns from the Motuihi Island grass-plots over the period of two years (1920 and 1921) are given in the following table :—

Plot No.	Fertilizer used when laying down Pasture.	Yield per Acre of Green-stuff.				Percentage Yield.*
		Tons	cwt.	qr.	lb.	
1	Check (no manure)	4	6	2	4	100·0
2	Radio, 336 lb. (3 cwt.) per acre ..	5	7	1	0	126·6
3	Superphosphate, 67·2 lb. per acre ..	5	5	3	8	127·7
4	Lime (burnt), 67·2 lb. per acre ..	3	4	3	2	80·0
5	Coaldust, 201·6 lb. per acre ..	3	9	0	27	87·5
6	Check (no manure)	3	17	1	5	100·0
7	Superphosphate 67·2 lb., and lime 67·2 lb. per acre	5	19	1	21	144·3
8	Superphosphate 67·2 lb., and coaldust 201·6 lb. per acre	5	8	0	9	122·4
9	Burnt lime 67·2 lb., and coaldust 201·6 lb. per acre	4	16	1	26	102·8
10	Check (no manure)	4	19	1	4	100·0
11	Radio, 336 lb. (3 cwt.) per acre ..	5	0	0	1	100·7
12	Ephos basic phosphate, 336 lb. (3 cwt.) per acre	5	10	2	18	111·5
13	Ephos 168 lb. (1½ cwt.), and superphosphate 168 lb. (1½ cwt.) per acre	6	15	1	7	136·3
14	Basic superphosphate 112 lb. (1 cwt.), bonedust 112 lb. (1 cwt.), guano 112 lb. (1 cwt.) per acre	6	0	2	26	121·6

* For particulars of the method adopted to obtain the percentage yields, which provides a fairly reliable basis of comparison, allowing as it does for disturbing factors, readers are referred to the previous article in the March, 1921, *Journal*.

From this table it will be observed that the application of Radio manure to plot 2 has increased the crop-yield for the first two years about 26½ per cent. over and above the check plot, which received no manure. Taking the average of the two Radio plots, its application has increased the yield of grass 13½ per cent. over and above "no manure." Superphosphate alone, without the coaldust and lime, is slightly better than when in combination with them in the proportions which make up the Radio mixture. Superphosphate and lime on plot 7 have brought about an increase in yield of slightly over 44 per cent. over and above "no manure." If it is taken over the two years it has proved over 16½ per cent. better than plot 2 (Radio), or over 30 per cent. better than the average of the two Radio plots. The yield from plot 3, which received superphosphate alone, is over 5 per cent. better than that from plot 8, where the same amount of superphosphate was used, but with an equal weight of coaldust in addition. The added coaldust has lowered the yield. The superphosphate-lime combination has increased the crop-yield on plot 7 nearly 22 per cent. over and above that on plot 8, which received a superphosphate-coaldust dressing.

Summarizing the results since the laying-down of these plots in grass in the autumn of 1920, it is plain from the evidence to date that coaldust has lowered the yield wherever it was used. Taking superphosphate as a base, the lime added to it improved the fertilizer mixture, as shown by the increased yields. When the coaldust was added to superphosphate, or both superphosphate and lime, the mixture was not improved, but depreciated in value as a manure. It is clear that the Radio mixture would be better without the coaldust, as this affects adversely the good effects of the other ingredients.

Though not quite relevant to the present problem as to the value of coaldust as a fertilizer, the evidence furnished by these experiments shows that the opinion held by many farmers and others—namely, that a soluble manure like superphosphate is a mere stimulant, and produces no good lasting effect—is erroneous. The good effects of the small amount of superphosphate applied with the grass-seed have been maintained throughout two seasons. I know of no reliable field evidence to the contrary.

RADIO AS A TOP-DRESSING ON PERMANENT PASTURE.

In addition to the foregoing carefully controlled experiments at Motuihi Island, the field adjoining the Department's Experimental Area at Albany, and leased for grazing purposes, was secured in June, 1920, and set out in six plots. Owing to failure to satisfactorily negotiate with the then lessee we were unable to set out this area so as to include checks, as at Motuihi. Further, for the same reason, we were unable to shut up the top-dressed plots in 1920 and cut for hay in order to make comparisons as to the weight and quality of material produced. This season, however, through the courtesy of Mr. A. Potter, of Albany, who now has the grazing-rights of the area, we were enabled after again top-dressing the plots to shut it up and cut for hay.

The following table was prepared after the hay was weighed on 17th December last. The area of each plot is $\frac{3}{10}$ acre.

Plot No.	Fertilizer used.	Yield of Hay per Acre. Cwt.	qr.	lb.	Remarks on Standing Crop.
1	Malden Island guano 1½ cwt., and carbonate of lime 1½ cwt. per acre (applied 29/7/21)	14	0	2	Poor plot.
2	Radio, 3 cwt. per acre (applied 29/7/21)	21	2	5	Heavy with Lotus hispidus (angustissimus) near one end of plot.
3	Basic slag, 3 cwt. per acre (applied 29/7/21)	32	1	18	An even plot with a fair amount of white clover.
4	Adelaide guano 1 cwt., basic super 1 cwt., steamed bonedust 1 cwt. per acre (applied 29/7/21)	33	3	3	
5	Basic slag 1½ cwt., superphosphate 1½ cwt. per acre	39	0	9	Best plot for white clover.
6	Superphosphate 3 cwt. (applied August, 1921), and carbonate of lime 1 ton (applied June, 1921) per acre	35	2	1	Fair amount of white clover. Most Lotus and suckling-clover. One of few plots showing rye-grass.

The results from the foregoing test, in so far as one can judge from such evidence (which is certainly better than opinions given after an eye inspection is made), show that the Radio plot 2 compares very unfavourably with plots 3 to 6.

Next season it is the intention to top-dress the plots at Motuihi and Albany, repeating the fertilizer ingredients previously used, both as to kind and quantity, and bring these trials to a close.

Dairy-produce Store.—The Smithfield Freezing-works, near Timaru, have been officially appointed a store for the storage, cooling, or freezing of dairy-produce prior to export.

New Zealand Shorthorn Herd-book.—Volume xvii (1921) of this publication has now been issued. We acknowledge with thanks receipt of a copy from the Shorthorn Society.

Certificates in Beekeeping.—Since classes in beekeeping were instituted in 1915 at the Ruakura Farm of Instruction eighty-one persons have passed the examination held at the end of each season and gained the Department's certificate in beekeeping. Of this number twenty-eight passed in the 1920–21 season.

Birds and Root Crops.—Mr. J. W. Deem, Fields Instructor, Wanganui, commenting on the sowing of this season's root crops in the Wanganui and Taranaki districts, states that small birds have been particularly troublesome, and expresses the opinion that unless united efforts are made to control them it will be extremely difficult in future to get good stands of root crops in many localities. Sowings of mangolds appear to have suffered most severely this season.

PHYLLOXERA-RESISTANT VINE-STOCKS.

J. C. WOODFIN, Vine and Wine Instructor.

In view of the spread of phylloxera in the vinehouses of the Auckland Province grape-growers should ensure against this pest by grafting their vines on resistant stocks wherever a vine is being replaced or new vines being planted. The choice of a suitable stock for the conditions available can only be definitely resolved by experiment, as we have no records of their exact behaviour when growing in artificial borders and under glass. We have, however, to help us reports from different parts of the world of experiments extending over some forty years, and made under different climatic and soil conditions, and on numerous phylloxera-resistant vine-stocks and their hybrids. We have also some local outdoor experience.

European vines belong to one species, the Vitis vinifera, and will grow in most soils. The American vines from which the resistant stocks have been selected belong to several species differing from the European vines and among themselves, and each species, having adapted itself to special conditions, gives different results when planted under similar conditions of soil and climate. The gradual selection which has taken place with the object of discovering the variety which will give the best results in a given soil, and in its affinity for the variety of Vinifera to be grafted on it, has resulted in the choice of a few stocks of real value for the purpose. A good selection of these is grown at the Department's Arataki Horticultural Station, Havelock North, Hawke's Bay.

Judging from what we know of the Riparia species, whose natural habitat is on river-bed formations, with its tendency to send out horizontal roots having an inclination to rise to the surface, and thus adapting it more especially to surface feeding—a desirable condition in a vine border—it should be the most useful for growing in rich well-kept borders. These same qualities also indicate it as a suitable stock for growing on sandy soils and river-bed formations where the water-table is near the surface (but not in swampy or badly drained soils, which are quite unsuitable for grapes), and where the varieties with deeply penetrating roots like the Rupestris would lose their fibrous roots from decay, and thus be deprived of their means of obtaining water.

There are two Riparias now in general use, the Riparia Gloire de Montpellier and the Riparia Grand Glabre, both very good, the preference being generally given to the former. They root easily and take grafts well. The grafts are very vigorous, very fructiferous, and mature early. The Riparias do not succeed well in poor soils. The difference in size between the stock and scion under such conditions becomes very accentuated, the stock becoming more slender than the vine it supports. On account of the majority of the roots being near the surface and only a few shooting down perpendicularly to the water-table, it is essential that the borders containing Riparia stocks should be well mulched to preserve the moisture.

Among other stocks, the Solonis Robusta is a less vigorous grower and preferable for varieties of the Vinifera which do not set their

fruit well. It matures early and does well in the ordinary well-kept border, and is the best of all stocks for damp or brackish soils. It also does well near the seaside in sandy soils containing salt.

The Rupestris du Lot has a very vigorous growth, which adapts it to deep poor soils containing lime or not. In rich soils it produces too much wood and foliage for the favourable development of the fruit. It will also grow in soil containing salt. Rupestris 3309 is at present the most generally employed stock for medium soils in France. The demand for it surpasses that for all others. Rupestris 3306 is very similar in its aptitudes, and is preferable to 3309 in clay soils containing lime. The Mouvedre-Rupestris 1202, like the du Lot, makes too much foliage in rich soils, but has proved an excellent stock for most varieties in the poor clay and gum lands of the Auckland Province.

A number of other varieties suitable for various classes of soil are available at the Arataki Station, most of them worth trying. As already mentioned, it is only by experimenting under available conditions that suitable stocks can be advantageously selected.

SOME RECENT CHANGES IN THE NAMES OF PLANT-DISEASES.

[*Continued from November Issue.*]

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

KEY TO THE REASONS FOR CHANGES IN NAMES.

In the several parts which follow the reason for the change in scientific names is indicated in each case by a Roman numeral " I," " II," &c. This numeral indicates that the change has been made for the reason briefly summarized in the corresponding key paragraph as follows :—

I. Change necessitated through the perfect stage of the causative organism becoming known.

II. Change necessitated through the generic name of the causative organism becoming untenable.

III. Change necessitated through the adoption of the International Botanical Rules, Brussels, 1910.

IV. Change necessitated by the difference between American and international nomenclature.

V. Change necessitated through the previous wrong determination of the causative organism.

Rejected common names are also given, but are not keyed—*i.e.*, the reason for rejection is not given in their case.

PART II.—DISEASES OF SMALL-FRUITS.

As in the case of Part I, the various diseases dealt with in this section have been placed in alphabetical order under their common names, and in the following groups : (*a*) Currants and gooseberries ; (*b*) grapes ; (*c*) raspberries, blackberries, and loganberries ; (*d*) strawberries ; and (*e*) tomatoes.

BLACKBERRIES. (See under " Raspberries.")

(*a.*) CURRANTS AND GOOSEBERRIES.

38. **Angular Spot,** *Cercospora angulata* Wint.
Angular leaf-spot.

This fungus causes brown spots on both surfaces of the leaves of currants and gooseberries. The mycelium is prevented from spreading for any distance by the bundles of the leaf, hence the angular nature of the spots formed.

39. **Cane Necrosis,** *Botryosphaeria Ribis* G. et D.
Cane-blight; cane-wilt.

This fungus attacks the canes of currants, causing them to wilt suddenly. Whole plants may be killed outright, but as a rule the organism is confined to one or two canes. This disease has usually been attributed to coral-spot (*Nectria cinnabarina* (Tode) Fr.), but Grossenbacher and Duggar have shown that when inoculated into healthy branches the conidia of that fungus are unable to produce cane necrosis.

40. **Circular Spot,** *Pseudopeziza Ribis* Kleb.
I. *Gloeosporium Ribis* (Lib.) M. et D. Currant leaf-spot; anthracnose.

This causes minute circular depressed holes in the leaf, stem, and fruit of currants and gooseberries.

41. **European Mildew,** *Microsphaeria Grossulariae* (Wallr.) Lév.
II. *Alphitomorpha Grossulariae* Wallr. Gooseberry-mildew; powdery mildew.

This is an uncommon fungus; it attacks the leaves and young shoots.

42. **Leaf-spot,** *Mycosphaerella Grossulariae* (Fr.) Lindau.
II. *Sphaerella Grossulariae* (Fr.) Auersw. II. *Sphaeria Grossulariae* Fr. I. *Septoria Ribis* Desm. Gooseberry-rust; gooseberry leaf-spot.

This fungus is common on currants and gooseberries; spots caused by it may readily be recognized by the irregular outline and paler centre. Infected leaves turn yellow and fall prematurely.

(16.) **Silver-blight,** *Stereum purpureum* Pers.
(See also under "Stone-fruits.")

(*b.*) GRAPES.

43. **Grape Anthracnose,** *Gloeosporium ampelophagum* (Pass.) Sacc.
V. *Ramularia ampelophaga* Pass. II. *Sphaceloma ampelinum* de Bary. Black-spot; vine anthracnose.

A disease which attacks leaves, shoots, and fruits, where it forms small depressed cankers. When the fruits are severely attacked they wither and dry up.

44. **Grape-mildew,** *Uncinula necator* (Schw.) Burr.
V. *Erysiphe necator* Schw. I. *Oidium Tuckeri* Berk. Powdery mildew.

Grape-mildew attacks leaves and shoots, covering them with a greyish-white mould.

(4.) **Ripe-rot,** *Glomerella cingulata* (Stoneman) Sp. et v. Schr.
(See also under "Pome Fruits.")

45. **Vine Sclerotinia,** *Sclerotinia Fuckeliana* (de Bary) Fcl.
II. *Peziza Fuckeliana* de Bary. I. *Botrytis cinerea* Pers.

This fungus attacks leaves and fruit, covering them with a dense ashy-grey mould.

LOGANBERRIES. (See under "Raspberries"

(*c.*) RASPBERRIES, BLACKBERRIES, AND LOGANBERRIES.

46. **Cane-wilt,** *Leptosphaeria Coniothyrium* (Fcl.) Sacc.
II. *Sphaeria Coniothyrium* Fcl. I. *Coniothyrium Fuckelii* Sacc. Raspberry fireblight; raspberry cane-blight; tree-cricket canker.

This fungus causes a destructive wilt disease of raspberry-canes. It also attacks blackberries, particularly the fruiting panicles.

47. **Hypholoma Rot,** *Hypholoma fasciculare* Fr.
Raspberry root-rot.

This fungus may be readily recognized by the appearance of its fructifications soon after the death of the plant; these appear at the base of the plant, and are somewhat like mushrooms in appearance.

48. **Orange-rust,** *Gymnoconia Peckiana* (Howe) Trotter.
II. *Puccinia Peckiana* Howe. IV. *Gymnoconia interstitialis* (Schlecht) Lagh. IV. *Kunkelia nitens* (Schw.) Arth. I. *Caeoma interstitiale* Schlecht. I. *Caeoma nitens* Schw.

This rust is very common on blackberries and loganberries, but less so on raspberries. It forms conspicuous yellow masses on the under-surface of the leaf.

49. **Raspberry Anthracnose,** *Gloeosporium venetum* Speg.

This causes scurfy cankers on the stem. It is common on certain varieties of loganberry.

50. **Septoria Spot,** *Septoria Rubi* Westd.

A disease which forms small, more or less circular, spots on the leaf. It is common on all three hosts.

(*d.*) STRAWBERRIES.

51. **Rhizopus Rot,** *Rhizopus nigricans* Ehr.
Fruit-rot.

This fungus attacks strawberries in transit, reducing them to a pulp. It is a common rot in a great number of packed and stored fruits.

52. **Strawberry Leaf-spot,** *Mycosphaerella Fragariae* (Tul.) Lindau.
II. *Sphaeria Fragariae* Tul. II. *Sphaerella Fragariae* (Tul.) Sacc. I. *Septoria Fragariae* Desm.

This form of leaf-spot is common wherever strawberries are grown, forming conspicuous black spots with red margins on both surfaces of the leaf.

53. **Strawberry-mildew,** *Sphaerotheca Humuli* (DC) Burr.
II. *Erysiphe Humuli* DC. Powdery mildew.

A mildew which causes distortion of the leaves, and forms unsightly white blotches on the fruit.

(*e.*) TOMATOES.

54. **Black-stripe,** *Bacillus Lathyri* Manns et Tabenhaus.

This organism attacks the stem, where it forms long irregular sunken stripes. It also attacks the fruit, forming brown to black, more or less circular, sunken spots.

55. **Blossom-end Rot** (non-pathogenic?).
V. *Macrosporium Tomato* Cke. V. *Macrosporium Solani* Jones et Grout. V. *Fusarium erubescens* Appel et V. Oven. V. *Fusarium Solani* Mart. V. *Phytobacter Lycopersicum* Groenewege. Fruit-rot; black-spot; black-scab; tomato black-rot; fruit-blight.

This disease has been the subject of a considerable amount of investigation by pathologists, many of whom have arrived at widely different conclusions as to its cause. It now appears that the trouble is not caused by any pathogen.

56. **Early Blight,** *Alternaria Solani* (Ell. et Mart.) Jones et Grout.
II. *Macrosporium Solani* Ell. et Mart.

This fungus forms irregular brown patches on the margins of the leaves. After a time the leaves become strongly incurved and brittle to the touch.

57. **Fusarium Wilt,** *Fusarium Lycopersici* Sacc.
Sleeping-disease.

This fungus attacks the stem and crown; the conduction tissues become blocked with hyphæ, and wilt follows.

58. **Late Blight,** *Phytophthora infestans* (Mont.) de Bary.
I. *Botrytis infestans* Mont. Irish blight; downy mildew.

This attacks leaves and fruit, causing an evil-smelling black rot. The common late blight of potatoes.

59. **Leaf-mould,** *Cladosporium fulvum* Cke.
Tomato-scab; tomato-mildew; leaf-blight; leaf-rust.

A disease which covers the under-surface of the leaf with an olive-coloured mould. Where infection is severe, death of the infected leaf soon takes place.

(63.) **Sclerotinia Disease,** *Sclerotinia Libertiana* (Lib.) Fcl.
(See under "Artichokes.")

60. **Stem-canker,** *Mycosphaerella Citrullina* (C. O. Sm.) Grossenb.
II. *Sphaerella Citrullina* C. O. Smith. I. *Diplodina Citrullina* (C. O. Sm.) Grossenb. I, V. *Ascochyta Citrullina* C. O. Smith. Tomato-canker.

So far this fungus is confined to one locality in New Zealand. It attacks and destroys the stem; attacked plants quickly wilt and die.

61. **Tomato Leaf-spot,** *Septoria Lycopersici* Speg.

This fungus is the cause of a serious leaf-spot.

PART III.—DISEASES OF VEGETABLES.

In this section the diseases affecting only the commoner vegetables are dealt with. These are arranged in the same manner as formerly, the grouping being as follows: (*a*) Artichokes and sunflowers; (*b*) beans; (*c*) beets and mangolds; (*d*) cabbages, &c.; (*e*) celery, parsley, and parsnips; (*f*) lettuce; (*g*) melons, cucumbers, and squashes; (*h*) onions, &c.; and (*i*) peas. The diseases affecting potatoes and turnips will be given in a later section dealing with field crops.

(*a.*) ARTICHOKES AND SUNFLOWERS.

As these two plants belong to the same genus they are treated under one heading; fungi which attack the one invariably attack the other.

62. **Helianthus Rust,** *Puccinia Helianthi* Schw.

Artichoke-rust; sunflower-rust.

Although biologically distinct, the forms occurring on artichoke and sunflower are morphologically identical, so are here grouped together, as in this work only morphological distinctions are recognized.

This rust is not common. It attacks the leaves, forming numerous brown pustules on both surfaces.

63. **Sclerotinia Disease,** *Sclerotinia Libertiana* (Lib.) Fcl.

II. *Peziza sclerotiorum* Libert. III. *Sclerotinia sclerotiorum* Schrot. (nec. Mass.). V. *Sclerotinia sclerotiorum* Mass. V. *Sclerotinia perplexa* Lawrence. Lettuce stem-canker; sclerotium disease.

This is one of the most serious diseases we have to contend with. It attacks and destroys the stems of a great number of different plants; for example, I have observed it on artichokes, cucumbers, cabbages, beans, vetches, lettuces, spear-thistles, potatoes, tomatoes, sunflowers, lemons, lucerne, asters, &c. It may readily be recognized by the presence of numerous irregularly shaped, black, shot-like bodies embedded in (if the stem be hollow) or on the dead areas of the stem.

(*b.*) BEANS; INCLUDING BROAD OR WINDSOR, FRENCH, BUTTER, KIDNEY, LIMA, AND RUNNER BEANS.

64. **Broad-bean Rust,** *Uromyces Fabae* de Bary.

Bean-rust.

This rust is common wherever broad or Windsor beans are grown; it attacks the leaves, pods, and stems. It is confined to this host.

(63.) **Sclerotinia Disease,** *Sclerotinia Libertiana* (Lib.) Fcl.

(See also under "Artichokes.")

65. **Bean Anthracnose,** *Glomerella Lindemuthianum* Shear.

I. *Colletotrichum Lindemuthianum* Br. et Cav. I, V. *Gloeosporium Lindemuthianum* Sacc. et Magn. Pod-scab.

This fungus forms circular depressed spots on the pods, these shortly becoming covered with the conidia of the fungus, which are pink in mass. It also attacks leaves and stems. The fungus is transmitted in the seed. It does not attack broad beans.

66. **Phaseolus Rust,** *Uromyces Phaseolorum* de Bary.

V. *Uromyces appendiculatus* (Pers.) Link. V. *Uromyces Phaseoli* (Pers.) Wint.

This rust is not common. Its appearance on the plant is very similar to that of broad-bean rust, but broad beans are not attacked by it.

(*c.*) BEETS AND MANGOLDS.

67. **Beet Leaf-spot,** *Cercospora beticola* Sacc.

This causes whitish circular spots on the leaves. Where attacks are severe defoliation follows.

68. **Beet-rust,** *Uromyces Betae* (Pers.) Kuehn.

II. *Uredo Betae* Pers.

The uredo spores of this rust may be found all the year round on beet-leaves, and as aecidia have not been found in New Zealand it is extremely likely that the rust is perpetuated by this stage alone.

69. **Heart-rot,** *Mycosphaerella tabifica* (Prill. et Del.) Johns.

II. *Sphaerella tabifica* Prill. et Del. I. *Phoma Betae* Frank. I. *Phyllosticta tabifica* Prill. et Del. Beet-rot; mangold-rot.

This disease causes a dry rot of the roots of beet and mangolds.

BORECOLE. (See under "Cabbages.")

BROCCOLI. (See under "Cabbages.")

BRUSSELS SPROUTS. (See under "Cabbages.")

BUTTER BEANS. (See under "Beans.")

(*d.*) CABBAGES, BORECOLE, BROCCOLI, BRUSSELS SPROUTS, CAULIFLOWERS, KALE, AND SAVOYS.

70. **Black-leg,** *Phoma lingam* (Tode) Desmaz.

II. *Sphaeria lingam* Tode. V. *Phoma Oleracea* Sacc. V. *Phoma Brassicae* Thüm. Foot-rot; cabbage stem-rot.

This causes a serious rot of cabbage, attacking leaves and stems.

71. **Cabbage-mildew,** *Peronospora parasitica* (Pers.) de Bary.

II. *Botrytis parasitica* Pers. Leaf-rot.

This mildew attacks the leaves, covering them with a greyish-white mould. It is a difficult disease to control, as oospores capable of remaining viable for many years are formed within attacked leaves.

72. **Club-root,** *Plasmodiophora Brassicae* Wor.

Anbury; finger-and-toe; foot-rot.

A disease which distorts and forms large swellings on the roots. The resting spores are contained within these swellings, and may remain viable for many years.

73. **Ring-spot,** *Mycosphaerella Brassicicola* (Duby) Lind.
II. *Sphaerella Brassicicola* Duby. I. *Phyllosticta Brassicicola* McAlp.
I, II. *Phyllosticta Brassicae* (Curr.) Cke. Cabbage leaf-spot.

The cause of circular dark-coloured spots on leaves. It is common throughout New Zealand wherever the hosts are grown.

74. **White Rust,** *Cystopus candidus* (Pers.) Lev.
II. *Uredo candida* Pers. II. *Albugo candida* (Pers.) Rouss.

This fungus forms white blister-like swellings on the leaves, and frequently distorts the stems of certain crucifers—for example, shepherd's-purse (*Capsella Bursa-pastoris* Med.). It is difficult to control, as it occurs on so many garden-weeds belonging to the Cruciferae and readily spreads from these to the cultivated plants.

CAULIFLOWERS. (See under "Cabbages.")

(*e.*) CELERY, PARSLEY, AND PARSNIPS.

75. **Celery Cercospora,** *Cercospora Apii* Fr.
Leaf-blight; early blight.

A common disease, the cause of minute light-coloured spots on the leaves.

76. **Celery-spot,** *Septoria Petroselini* Desm.
Late blight; leaf-scorch.

This causes a serious leaf and petiole spot of celery. It also attacks the inflorescence, and forms its fructifications on the seeds. A biological species, *Septoria Petroselini Apii* Br. et Cav., has been separated from *S. Petroselini* Desm., but cannot be recognized here as it is morphologically identical with the latter.

CUCUMBERS. (See under "Melons.")

FRENCH BEANS. (See under "Beans.")

GARLIC. (See under "Onions.")

KALE. (See under "Cabbages.")

KIDNEY BEANS. (See under "Beans.")

LEEKS. (See under "Onions.")

(*f.*) LETTUCE.

77. **Lettuce-mildew,** *Bremia Lactucae* Reg.
Downy mildew.

An uncommon disease which forms white patches on the leaves.

(63.) **Sclerotinia Disease,** *Sclerotinia Libertiana* (Lib.) Fcl.
(See also under "Artichokes.")

This has frequently been wrongly determined as *Sclerotinia Fuckeliana* de Bary.

LIMA BEANS. (See under "Beans.")

MANGOLDS. (See under "Beets.")

(*g.*) MELONS, CUCUMBERS, AND SQUASHES.

78. **Melon Anthracnose,** *Colletotrichum lagenarium* (Pass.) E. et H.
V. *Colletotrichum oligochaetum* Cav. Fruit-rot.

Large, irregular, more or less circular, depressed spots are formed on the fruits by this fungus. It also forms cankers on the stems, causing the plants to wilt.

79. **Melon-mildew,** *Plasmopara Cabensis* Humphrey.
Cucumber-mildew.

80. **Melon-spot,** *Cercospora Melonis* Cke.
Cucumber leaf-blotch; melon leaf-blotch.

A disease which forms irregularly shaped spots on the leaves.

(60.) **Stem-canker,** *Mycosphaerella Citrullina* (C. O. Sm.) Grossenb.
(See also under "Tomatoes.")

So far this fungus has been collected only from the tomato, but in America it attacks cucurbits, forming large cankers on the stems.

(63.) **Sclerotinia Disease,** *Sclerotinia Libertiana* (Lib.) Fcl.
(See also under "Artichokes.")

(*h.*) ONIONS, LEEKS, AND GARLIC.

81. **Black Mould,** *Macrosporium parasiticum* Thüm.

This fungus is a wound parasite, and follows injury caused by onion-mildew. On the leaves it forms irregular black patches.

82. **Bulb-rot,** *Sclerotinia cepivorum* Berk.

A fungus which attacks onion-bulbs in the field and the storehouse. It is readily recognized by the numerous black sclerotia which lie embedded between the scales of the bulb.

83. **Onion-mildew,** *Peronospora Schleideni* Ung.
Downy mildew.

A common disease wherever onions are grown. It may be recognized by the presence of its smoke-coloured fructifications, which cover the surfaces of the leaves. Death of the leaf usually follows attack.

84. **Onion-rust,** *Puccinia Porri* Sow.
V. *Puccinia Alli* (DC) Rud.

An uncommon disease which forms irregular brown linear pustules on the leaves.

PARSLEY. (See under "Celery.")

PARSNIPS. (See under "Celery.")

(*i.*) PEAS.

85. **Pea-mildew,** *Erysiphe Polygoni* DC.

This attacks leaves, stems, and pods, covering them with dense masses of mycelium, from which arise the chains of conidia.

86. **Pea-spot,** *Mycosphaerella pinodes* (Berk. et Blox.) Lind.
II. *Sphaeria pinodes* Berk. et Blox. II. *Sphaerella pinodes* (Berk. et Blox.) Niessl. I. *Ascochyta Pisi* Lib. Pod-spot.

A common disease in peas, beans, and vetches, forming brown spots on the leaves.

(63.) **Sclerotinia Disease,** *Sclerotinia Libertiana* (Lib.) Fcl.
(See also under "Artichokes.")

POTATOES. (See under "Field Crops.")

RUNNER BEANS. (See under "Beans.")

SAVOYS. (See under "Cabbages.")

SQUASHES. (See under "Melons.")

SUGAR-BEETS. (See under "Beets.")

SUNFLOWERS. (See under "Artichokes.")

TURNIPS. (See under "Field Crops.")

WATER-MELONS. (See under "Melons.")

WINDSOR BEANS. (See under "Beans.")

(To be continued.)

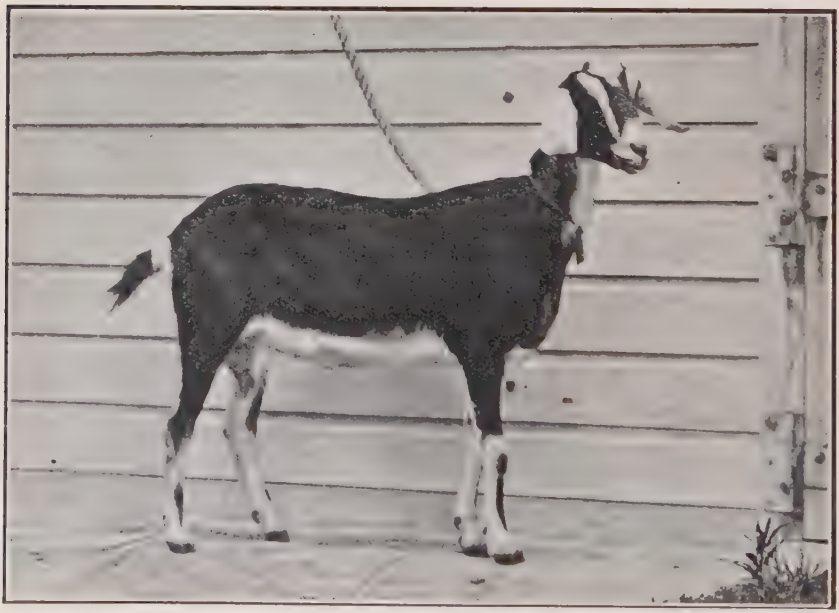
THE DEPARTMENT'S MILKING-GOATS.

On the following page are depicted some of the Department's recently imported milking-goats, the photos having been taken at Somes Island, Wellington, where they are located. The herd at present consists of one male and nine female Anglo-Nubians, and one male and one female Swiss Toggenburg. All are registered pedigree animals, and were selected for the Department by Mr. T. W. Palmer, secretary of the British Goat Society. They come from various studs in England, and it is interesting to note that in this case all the breeders are women. The Department does not intend to sell any of these goats or their progeny until a good-sized herd has been built up. When in a position to make supply due notice will be given. The object, of course, is to promote the keeping of goats of superior milking-strain, which hitherto have not occupied their due place in the economy of this country.

SOME OF THE DEPARTMENT'S PEDIGREE MILKING-GOATS AT SOMES ISLAND.

(See preceding page.)

THE SWISS TOGGENBURGS—MALE AND FEMALE.



ONE OF THE ANGLO-NUBIAN FEMALES.

TESTING OF PUREBRED DAIRY COWS.

DECEMBER CERTIFICATE-OF-RECORD LISTS.

THE appended lists, comprising the records of cows which received certificates during the month of December, 1921, are supplied by the Director of the Dairy Division, Mr. W. M. Singleton :—

LIST OF RECORDS.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Eileen's Treasure ..	H. Salway, Bell Block	2 11	241·6	365	9,794·7	579·42
Jersey Corner Fairy ..	A. C. Lovelock, Woodville	2 13	241·8	365	9,245·9	484·64
Orielton Rose ..	G. E. Reynish, Timaru	2 42	244·7	365	9,318·1	472·51
Miro Meadows Countess	A. A. Ward, Miro ..	1 334	240·5	365	6,825·7	380·68
Glenmore Molly ..	A. C. Lovelock, Woodville	2 15	242·0	365	6,005·2	377·70
Riverside Gold Berry	J. T. Belcher, Cardiff ..	1 299	240·5	313	6,515·4	371·28
Neathead's Glory Lass	S. R. Lancaster, Palmerston North	2 17	242·2	365	5,614·75	364·69
Lassie Lucerne ..	W. McGowan, Papatoetoe	1 277	240·5	334	6,633·8	341·47
Ladywell Peggie ..	W. J. Murray, Opotiki	2 25	243·0	360	7,941·6	339·38
Ladylike	Mrs. C. Day, Tamahere	2 28	243·3	353	4,879·7	296·71
Pencarrow's Welcome Lassie	Mrs. C. Day, Tamahere	1 358	240·5	330	4,380·6	272·33
Pencarrow's Golden Gift	Mrs. C. Day, Tamahere	1 219	240·5	343	3,843·3	255·15
Carnation's Lady ..	Mrs. C. Day, Tamahere	2 1	240·6	365	4,284·7	244·99
Senior Two-year-old.						
Snow View's Wreath	D. P. F. Malone, Kaponga	2 245	265·0	345	6,994·5	414·71
Waipiko Crystal ..	W. J. Murray, Opotiki	2 251	265·6	365	8,730·2	380·05
Three-year-old.						
Pencarrow's Triangle Queen	Mrs. C. Day, Tamahere	3 210	298·0	365	6,145·5	405·68
Ivondale's Sunbird ..	P. J. Petersen, Brixton	3 270	304·0	308	7,548·5	362·05
Briar's Queen ..	H. H. Buxton, Hawera	3 34	280·4	288	7,008·5	328·72
Renona	S. Atkinson, Papatoetoe	3 301	307·1	365	5,813·9	324·75
Clydesdale's Red Widow	G. R. McKenzie, Carnarvon	3 32	280·2	286	6,247·9	307·65
Four-year-old.						
Valonia	W. H. Smith, Raumati	4 15	315·0	365	9,274·6	554·21
Glow	T. S. Edwardes, Tiakitahuna	4 224	335·9	338	6,652·0	424·73
Mature.						
Elf's Beauty ..	H. B. Lepper, Lepperton	7 69	350·0	365	13,679·65	800·75
Bell Bird	Clague Bros., Manaia	5 36	350·0	365	11,713·7	597·80

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Waipiko Daylight ..	J. W. Bradey, Te Horo	6 30	350·0	323	9,340·6	515·60
Golden Sunbeam ..	C. A. Care, Cambridge	5 352	350·0	348	8,158·9	479·33
Eileen's Lady ..	C. A. Care, Cambridge	5 295	350·0	324	8,598·9	468·53
Breeze	W. V. Hosking, Stratford	9 302	350·0	361	7,845·5	447·93
Ivondale's Queen of Belgium	P. J. Petersen, Brixton	5 62	350·0	349	8,147·3	447·66
Snow Crown ..	W. H. Fitness, Rehia	8 167	350·0	358	8,737·7	436·91
Ponga's Girl ..	R. C. Leach, Woodville	6 80	350·0	308	8,096·1	435·25
Roslyn Lady Bon ..	J. Harris, Bombay ..	6 14	350·0	323	8,246·1	423·46
	FRIESIANS.					
Junior Two-year-old.						
Oaklea Segis Bonnie	Knight and Sons, Ongarue	1 307	240·5	327	11,403·3	419·73
Colinton Kittanora Inka	R. Colee, Greendale ..	2 44	244·9	365	11,709·0	402·23
Pareora Terren ..	A. S. Elworthy, Timaru	2 19	242·4	365	9,048·3	349·95
Clothilde Pride ..	H. Johnson, Stratford	1 294	240·5	365	8,228·0	311·92
Senior Two-year-old.						
Oaklea Millbrook de Kol	Knight and Sons, Ongarue	2 224	262·9	365	12,916·4	460·36
Countess Indi Surprise	C. H. Steadman, Kamo	2 213	261·8	360	10,507·3	340·45
Junior Three-year-old.						
Lillith Mercedes of Hawkridge	R. Colee, Greendale ..	3 30	280·0	365	16,818·8	559·95
Ryvington Pride ..	T. O. Hodgson, Tamahere	3 1	277·1	365	10,632·9	454·32
Senior Three-year-old.						
Hauraki VII ..	T. O. Hodgson, Tamahere	3 274	304·4	365	14,168·2	500·62
Lorna Mighty ..	C. H. Steadman, Kamo	3 348	311·8	350	11,908·6	426·10
Oaklea Nanny Pride	Knight and Sons, Ongarue	3 298	306·8	337	11,569·0	407·33
De Kol of Hawkridge	R. Colee, Greendale ..	3 340	311·0	365	10,123·7	391·85
Hauraki Victress ..	T. O. Hodgson, Tamahere	3 203	297·3	310	8,684·4	316·95
Senior Four-year-old.						
Buttercup III of Ashlyn	H. R. Green, Kairanga	4 305	344·0	365	20,694·25	833·26
Kittanora Alcartra ..	R. Colee, Greendale ..	4 306	344·1	365	13,549·2	436·46
Mature.						
Ashlea Dinah ..	R. Colee, Greendale ..	6 3	350·0	365	13,034·5	583·45
Bessie Tulliver ..	C. H. Steadman, Kamo	..	350·0	365	15,754·4	558·54
Belle of Friesland ..	C. H. Steadman, Kamo	8 34	350·0	330	14,046·7	501·81
Alcartra Segis Clothilde Belle	H. Johnson, Stratford	7 82	350·0	362	11,297·0	392·89

Rabbit Districts.—The formation of the Manuherikia Rabbit District in the Otago Land District, and of the Umutawa, Maru, Waotu, Waimanu, and Te Mania Rabbit-proof Fencing Districts in the Auckland Land District, was notified in the *New Zealand Gazette* in December.

WORK FOR THE COMING MONTH.

THE ORCHARD.

FIREBLIGHT.

FIREBLIGHT having made its appearance at Patea, it behoves all orchardists in other districts south of the Auckland Province to keep a vigilant watch on their fruit-trees and immediately report to the Department any suspicious signs that may be observed. Further infection has also been reported at Warkworth and Whakatane. Fireblight may be recognized in general by the wilting and dying of blossoms, spurs, twigs, and branches. The affected foliage turns black in the case of the pear and brownish in the apple, and remains hanging on the twigs—not falling, as is usual with other dead leaves. The bark of the tree becomes a dark colour, and later in the season assumes a cankerous appearance.

The following extract taken from a letter received from Professor Barss, of the Oregon State Agricultural College, U.S.A., bears out our New Zealand experience in relation to hawthorn and its susceptibility to the disease: "It is a well-known fact that hawthorn in this country is capable of carrying the disease and of acting as a source of infestation for the orchards near which it may be located. In the Willamette Valley we have made a systematic effort to locate infected hawthorn-trees and native trees related to the apple and pear botanically, which are also subject to fireblight. The infected trees have been systematically destroyed, and we believe that this practice has effectively reduced the chances of the development of the disease in our orchards. Certainly since we began this activity a threatened invasion of the commercial orchards in the Willamette Valley has practically disappeared, and we are no longer in fear of it. In those sections of Oregon which seem to be most favourable for the development of fireblight hawthorn is, I believe, not very abundant, and, as a rule, does not constitute a serious menace to the orchards. We are much more concerned about the natural spread of the disease from one orchard to another than from the wild hosts of the disease to the orchards, although this feature should not be overlooked by any means in a territory where violent attacks by fireblight are sustained by the wild trees. In the fruitgrowing sections where fireblight has made its appearance it is customary for inspectors to scour the hillsides and the water-courses in a search for possible infection among the native brush. Such cases as are discovered are immediately cut down, and the trees are destroyed by burning, but no effort is made to destroy the susceptible trees unless the disease has already made its appearance in the vicinity."

EXPORT AND GENERAL.

The export working-conditions for the coming shipping season are published elsewhere. As will be seen, the introduction of a lower grade, to be known as "Good" grade, is being tried at the request of a number of exporters. It is not intended, however, that this grade should come under the provisions of the Government guarantee.

General orchard operations for the various districts are contained in the following notes. Owing to space restrictions it has been arranged that one Instructor shall supply the notes for Nelson, as the same conditions practically apply over the whole fruitgrowing area of that province.

—*W. T. Goodwin, Assistant Director of the Horticulture Division.*

AUCKLAND.

It will now be time to slacken work with the cultivator. If cultivation has been carried out in the proper manner up to the present the soil should be in fairly good condition, and no benefit is obtained by continuing the work into the autumn. Some attention should be paid to the sowing of a cover-crop for ploughing in during early winter; field-peas, vetches, and lupins are all suitable for this purpose. Local conditions always have to be considered.

Picking and marketing of stone-fruits will be in full swing. Care should be taken to pick the fruit so that it will arrive on the market in good condition. If it is for the local market and for almost immediate use it should be left on the tree as long as possible so that it will develop all its natural flavour and blush. If, on the other hand, several days must elapse before it reaches the market the fruit should be picked while firm yet fully grown, otherwise it will become tough and leathery and have very little flavour. Several pickings should be made, otherwise good results will not be obtained. It should always be remembered that well-grown, highly coloured, and good-flavoured fruit means greater consumption, and therefore better returns to the grower.

Williams Bon Chrétien pears should not be allowed to remain on the trees too long. These pears will ripen although gathered very green, while if they remain on the trees too long they become dry and tasteless and of very little value from a commercial point of view.

Spraying operations must be continued, and last month's notes still hold good. Black Leaf 40 should be added where woolly aphis is in evidence on apples, and also for black aphis on stone-fruit; use 1 gallon to 800 gallons of water, with the addition of 4 lb. of soap to every 100 gallons of water.

—L. Paynter, Orchard Instructor, Hamilton.

HAWKE'S BAY.

Spraying for codlin-moth and leaf-roller will consist in repeating applications of arsenate of lead. Many growers withhold the arsenate as no moth is evident, only to find that the brood which hatches out at this season will nullify the effects of all the earlier spraying-work. It is not uncommon to find young grubs in packed fruit where spraying has been suspended too early. At this season of the year arsenate may with advantage be applied up to within a few days of picking.

Though the district is very free from black-spot this season, infection may occur if the weather continues damp. Keep a good lookout for black-spot and apply lime-sulphur, 1–100, or bordeaux, 3–4–40, at the first signs of trouble. For woolly aphis Black Leaf 40 has proved the most satisfactory summer control. This preparation may be used in combination with arsenate of lead, or lime-sulphur, or both, but if used alone 3 lb. of soap must be added. Whatever the preparation used it should be applied with a good pressure and a direct hit. For red-mite control lime-sulphur, 1–100, should be applied at frequent intervals.

Applications of arsenate of lead, as for codlin-moth, will control pear-slug on plum, pear, and quince trees. With plums nearing ripening hellebore powder may be used; though less effective than arsenate, it is non-staining, and may be used right up to picking-time at the rate of ½ oz. per gallon of water. Where trees are infected with powdery mildew spray with atomic sulphur, 1 lb. to 10 gallons of water, every three weeks. Pick off and destroy all infected twigs. Spray with lime-sulphur, 1–120, or bordeaux, 3–4–50, for plum-rust.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

The stone-fruit harvest will now soon be over, and the apple harvest is about to commence. Glancing back over last year's experience at this season the most important lesson learned perhaps is the need to pick the early varieties of apples and pears at the first sign of maturity. This may be a slight paling in the shade of the green colour of the fruit—a much more reliable indication than the amount of red colouring. With pears it will probably be that they part from the spur readily when lifted. Signs of maturity vary with different varieties, but, for export purposes more especially, it is desirable to pick at the *first* sign. This does not mean that a tree should be stripped as soon as a few fruits are ready. Only the fruit which is ready should be picked. With most classes of pip-fruit trees grown here the early picking will be from the top and outside of the upper branches, the more backward fruit being on the inside and about the base of the tree.

Considerable difference of opinion exists as to the proper time to place fruit in cool store. My observations go to show that, at this season of the year more especially, apples picked one day should be packed the next, and be placed in cool store on the third. A great many experiments show heavy loss from delayed storage, more especially with the earlier fruits. The carrying-out of this suggestion may seem to require rather hurried work, but it just means arranging to have the number of pickers, graders, and packers in the right proportions.

The necessity for transport services to handle packed fruit with care and despatch is often impressed upon the grower by serious losses that are only too common. This delay is sometimes due to careless marking, or marks that are not legible. It is a tedious and tiresome job handling such merchandise, and a frame of mind is created which does not make for either careful or prompt despatch. Stencilling the cases should be given careful attention. Avoid smudging, and place the brands in correct position. Those using block ink will find it ready for use at all times if it is placed in a flannel bag and allowed to lie in ½ in. of water.

—*W. C. Hyde, Orchard Instructor, Nelson.*

CANTERBURY.

The spraying notes which appeared in the December *Journal* still hold good for both stone and pip fruits.

The latter part of January and the month of February constitute a good time to bud to better varieties poor and worthless kinds of fruit-trees. Be sure that the buds to be used are taken from highly productive trees known to produce a good quality of fruit. Insert the bud on the outer or underneath side of the branches being worked. Besides the bark lifting more easily, a better-shaped tree will be obtained than if the buds are inserted on the inside.

Where trees are found to have too much growth throughout the centre superfluous wood only may be cut back to its base. Thinning should not be commenced until after the terminal buds have set. This will open up the centre of the tree and admit sunlight, which aids the development and ripening of wood and fruit spurs. The leaders and heavy limbs should not be cut at this time.

The land should be given a thorough cultivation so as to break any crust which may have formed and to check the growth of weeds. Hand hoeing should be done around the trees so as to loosen the soil missed by the cultivator. Growers intending to grow a crop between the trees for green-manuring purposes should order their seed now so that it will be on hand when required.

Care should be exercised that fruits are not allowed to become too ripe before being picked. The time to pick is one of the most important problems in the successful marketing of fruit. With stone-fruits the correct degree of ripeness depends upon the distance from the markets. They should arrive on the market sufficiently firm to permit the retail fruiterer to hold them in good condition for from two to three days. Early apples are ready when they have attained full colour, and when the fruit-stalk will readily part from the spur if the fruit is bent upwards with a slightly twisting motion. Early pears should be picked as soon as they have reached full size, and before they begin to colour, and when the fruit-stalk readily parts from the spur. Both early apples and pears should be placed on the market without delay.

From time to time specimens of fruit are submitted for naming without any description of the habit or growth of the trees, or any particulars whatever. It is advisable that the specimens should be accompanied by a description of the tree, stating when the fruit ripens, the name (if any) by which it is locally known, and any other information which would be of assistance. At least three typical specimens with stems attached should be sent.

—*W. K. Dallas, Orchard Instructor, Christchurch.*

OTAGO.

Marketing of stone-fruits will be in full swing from now on, but the orchardist must not neglect spraying for pests. Powdery mildew is still giving trouble and spreading rapidly. Continue the application of lime-sulphur, 1–120, or atomic sulphur, 8 lb. to 100 gallons. When using lime-sulphur it is advisable to add 3 lb. of atomic sulphur to every 100 gallons. In addition to spray treatment pick off and burn all affected wood and leaves.

Where any of the aphides are present use Black Leaf 40, 1–800. For codlin-moth, leaf-roller, &c., arsenate of lead, 3 lb. paste or 1½ lb. powder to 100 gallons water, should be periodically applied to keep the rapidly growing fruit covered with a protective covering. This can be applied as a combined spray with lime-sulphur, Black Leaf 40, or atomic sulphur. When using arsenate of lead as a combined spray with any of the other preparations named it will be found advisable to use 3 lb. of unslaked lime to every 100 gallons to prevent scorching of foliage and fruit.

—*B. G. Goodwin, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

CAREFUL management of the growing pullets under the most favourable conditions possible should be the chief concern of the poultry-keeper at the present time. Remember that the treatment they receive now will have an important influence on their future laying-capacity. The great importance of thoroughly clean quarters and clean runs cannot be too strongly emphasized. One has only to compare chickens being reared in a run which has been well rested and which is fresh and clean, with those in stale quarters and tainted runs, to realize the great importance of clean ground for the growing bird. I have always favoured alternate runs to a poultry-house, in order that the birds may have frequent changes on to clean ground, and a longer experience in utility-poultry keeping emphasizes the importance of this practice.

On all plants an endeavour should be made to turn over and work up the soil so as to expose it to the influence of the atmosphere for some months, and to lime it well before seeding. Some poultrymen grow in the alternate runs rape or Thousand-headed kale. This is an excellent idea. These plants grow very rapidly and are much appreciated by birds of all ages. Within a few weeks sufficient growth is made to provide good shelter and shade for the young birds, while in addition they have ample room to exercise in securing the young leaves, of which they are very fond. Do not think because there is long grass in the runs that this is good enough for the growing chicken, or, indeed, any class of poultry. As a general rule any grass that may be in a run at this season of the year is rank, and contains too much fibrous material to be of any real value as a green food. There is a great variety of plants suitable for green-feeding purposes, among which may be mentioned finely chaffed lucerne, clover, green oats, or watercress, while cabbages, silver-beet, mangolds, &c., may also be used to advantage.

No care and attention is too good for the pullets that are expected to produce a heavy yield of eggs next winter. Above all things, they require good sound food, grit, and clean water. When the birds show any sign of prematurity rich foods such as meat, milk, &c., should be eliminated from the ration.

With a view to retarding early laying, which is undesirable until the birds have reached an age of at least six months, crushed sound plump oats may with advantage be their chief diet. Beware of inferior-quality oats, which consist very largely of husks having no food value. Boiled wheat or barley makes a splendid change for growing stock. It should, however, be well boiled, as it is then relished by the birds to a greater extent than when only half-cooked.

The successful rearing of chickens depends on attention to numerous details, among which may be mentioned the provision of clean, well-ventilated houses which are free from draught and from insect pests. This, together with liberal feeding, ample room for exercise, and a keen eye for cleanliness, is a matter that should be always kept in mind if healthy development is to be attained.

INTESTINAL WORMS.

Referring again to the necessity of clean ground for the successful rearing of young stock, it may be mentioned that many cases of mortality and poor growth in young stock which have recently come under my notice are due entirely to the presence of intestinal worms. In each case, on making an investigation on the spot, the cause was made apparent—the runs were found to be in an absolutely poultry-sick condition. In other words, they provided an ideal breeding-ground for practically all kinds of internal parasites which affect poultry. It is safe to say that thousands of birds six weeks old and onward are lost annually from no other cause, to say nothing of the reduced egg-yield and the unthrifty condition of flocks so often caused by these enemies of the fowl.

Like most of the inquiries received, those in regard to worms usually ask for the best cure, but seldom seek for methods of prevention. There are certainly effective cures, but even with the best of these the cure will only prove temporary if the cause is not first removed. Prevention is the great essential. If, therefore, worms commence to give trouble, the soil should be turned over, well limed, sown down with grass, rape, kale, oats, &c., and given a rest. Never allow birds

of any age to scratch in the tip where droppings, litter, &c., from the fowlhouse have been deposited, as this is a great source of danger both in regard to disease and internal-parasite infection.

A common indication of the presence of worms is that the birds stretch their necks and make a sort of screeching noise, both by day and night, while they usually have an unkempt appearance. Where birds are badly affected with worms these will be readily found by opening and following the digestive tract with a small penknife. For treatment, first starve the flock for a day and then give them a dose of Epsom salts (about 1 oz. packet to every twelve birds) dissolved in the water with which the mash is mixed, adding also to the mash some sulphur (about the same quantity as of salts), and pure spirit of turpentine (a teaspoonful for every five birds), the whole to be thoroughly mixed with the mash ingredients before these are moistened. The effect of this diet given after a fast will be to expel the worms. Keep the birds confined in the house during the time of treatment, and afterwards thoroughly clean up and disinfect the quarters to lessen the risk of reinfection. This treatment should be repeated after a week's time; but, as before mentioned, if a recurrence is to be prevented the runs should be dug up, limed, and sown down.

THE BREEDING COCKERELS.

Many poultry-keepers, after selecting the most promising cockerels for future breeding purposes, place them in small coops or confined quarters. This is a mistake, as such conditions do not tend towards promoting vigorous and healthy growth. Confinement is necessary in fattening cockerels, but it is most undesirable in the case of those it is intended to breed from, it having the effect of overforcing the birds, a common cause of leg-weakness and other troubles such as falling combs, &c. In the building-up or maintenance of a heavy-laying strain the question of stamina in the male is of supreme importance. I therefore cannot suggest a better way of promoting this than by giving the growing bird a good range under the most natural conditions possible. Of course, this should go hand-in-hand with good breeding, housing, and general efficient management.

THE APIARY.

F. A. JACOBSEN, Apiary Instructor.

EXTRACTING.

DURING the ensuing weeks the beekeeper will have his time fully occupied. Extracting the season's honey crop, the most congenial of the year's work, has begun in some districts. The Dominion surplus this season is expected to be up to the average, some districts reporting light crops, while others expect more than usual.

As regards equipment, a reversible two-, four-, six-, or eight-frame extractor, according to the number of colonies, is required, mechanical power being advisable in the case of the two latter sizes. A roomy bee-proof extracting-house with workshop attached, and with sufficient room in the extracting portion to contain the extractor, several tiers of supers, honey-tanks, &c., is very desirable. The tanks would, of course, vary in size according to the number of colonies and the average crop. One large tank is required for settling the honey, and, if desired, a smaller one can be used for improving the granulation. A capping-melter or an uncapping-knife can be used in conjunction with a honey-capping press. Personally, I find the Bingham uncapping-knife the handiest for general use. It can be heated either by steam or hot water, the former being most satisfactory. A set of scales to weigh up to 1 cwt. will complete the equipment.

A number of beekeepers claim that they secure more honey by extracting three or four times in the season. This is probably correct, but under this system they must adopt some method of artificial ripening. The majority of large producers think it best to extract but once—that is, when all the combs are sealed. A better sample of honey, having a heavy body containing the full-strength aroma of the flowers from which the nectar was gathered, is then secured. If too much green or uncapped honey is taken from the hives it will injure the quality of the whole, and possibly start fermentation. The process of ripening the honey in the hives by the bees precludes such risks, as sealed honey which

is quite matured contains only about 16 per cent. of water, while green honey contains a much larger quantity. It is the water content that governs the keeping-quality of honey.

STORAGE-ROOM.

As previously advised, continue to place additional supers on the hives immediately the last super is two-thirds full. Lack of attention in this respect will reduce the crop considerably.

VITICULTURE.

J. C. WOODFIN, Vine and Wine Instructor.

VINEYARD AND CELLAR.

THE material for the coming vintage should now be overhauled, cleaned, and completed where necessary, and provision made for the incoming wine. Vats and casks should be rendered wine-tight by tightening the hoops and soaking the wood, either by spraying them or filling them with water. If the water is to remain in the wood several days it is desirable to add an antiseptic, such as bisulphide of lime, in the proportion of 1 in 1,000.

Any doubtful wood should either be discarded or put on one side until treated properly. A great deal of wine is annually spoiled or diminished in value through wine being stored in tainted containers. Vats showing any signs of mould should be thoroughly scraped and washed out with a solution of caustic potash, and where it is suspected that the flavour of mould, or any other substance that might deteriorate the wine, has impregnated the wood, the parts affected should be painted over with an impermeable substance—either gumlac or paraffin. In vats which have contained diseased wines it is essential to destroy the germs, which may still be lodged between the staves, by steaming or by filling with water containing ½ per cent. of bisulphide of lime.

Some notes on phylloxera-resistant vine-stocks are published as a separate article in this issue.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THE most pressing work at the present time is to finish the planting of leeks, cabbages, savoys, broccoli, kale, and brussels sprouts required for use during winter and early spring. Autumn Giant cauliflowers should have been planted several weeks ago, but if good plants are available they may still be planted with a good chance for success if this is done without further delay. Brussels sprouts should be well established by this time; late planting does not answer. Leeks planted now will not equal those planted a month ago, as this plant requires a long period of growth. Sow garden swedes for winter use. A small breadth of white turnip can also be sown; the middle of March is the time to sow these for winter use. Make a last sowing of French beans. Sow and plant lettuce.

Spinach: This is one of the most useful winter vegetables and one of the most productive. In the cooler parts of the Dominion sow at once; the middle of February is early enough in the middle districts; and a month later serves in Hawke's Bay and Auckland. Sow in good soil in rows 10 in. to 15 in. apart, and thin the plants to 9 in. or 10 in. apart. For market-garden purposes they should not be thinned, as the whole plants are drawn and made up in bundles. In private gardens the large leaves are taken, the plants being left to produce more leaves.

Silver-beet: Sow at once in rows 15 in. apart and thin plants to 12 in. There are a number of varieties of this plant. One with green leaves of moderate growth is known as "perpetual spinach"; another is known as "seakale beet," this because of the large white leaf-stalks, which are common to many varieties. Swiss chard has large smooth leaves and broad white stalks. Lucullus has crinkled leaves of pale green and large white leaf-stalks. The latter is the best garden variety, as it makes a large plant and is useful also for poultry-feed.

Cabbages for early spring: Experienced growers know that the difficulty in getting early heads lies in the liability of the plants to bolt—that is, to go to flower instead of hearting. The cabbage is a biennial plant and throws up flower-heads in the second season. All biennial plants have a strong tendency to flower in spring. For spring use cabbage-seed must be sown in autumn. The problem has always been to discover how early this can be done. If sowing is left too late there is no progress made, while if too early they bolt. The time adopted as safest and most useful is the last week in March, except in the coldest districts, where sowing is a month earlier. These dates, however, require revision in certain cases. Plant-breeders in England have raised a new type of cabbage, such as Sutton's April, Sutton's Flower of the Spring, and Ellam's Early, in which the tendency to premature flowering has been suppressed to such a degree that it only rarely occurs. Seeds of these varieties may be sown at least six weeks earlier than was formerly the practice—that is, about the middle of February.

Celery.

Celery should be in the ground, and it may now be considered late for further planting. First-class heads are not likely to result from late planting. (The foregoing remarks apply to most places in the Dominion; a few extra-warm places are not included. In such places planting can be done several weeks later.) There are a number of ways of growing celery. Until quite recently the variations were in the number of rows planted in a trench, trenches being always used. The number of rows in a trench ranged from one to twelve, the one-row method being adopted when extra-fine heads were of greater consequence than economy in production. This latter system is seldom adopted except for show purposes or in small gardens. In market gardens in the Old Country a large number of rows are planted. Two rows in a trench was, and still is, the practice in good private gardens, and for general purposes may be regarded as the best. This system produces good heads, and requires less manual skill than does a larger number of rows.

In planting a double row the plants are placed in pairs parallel with each other, each pair being 9 in. or 10 in. apart. The plants are placed in pairs to facilitate moulding up. Chinese gardeners are now dispensing with trenches; they plant on the flat in beds of varying width, usually about 6 ft. wide, which enables weeding to be done without treading on the beds. So-called self-blanching varieties are grown, usually Henderson's White Plume. The plants are set about 6 in. apart, and no moulding-up is done. Close planting shuts out a good deal of sunlight, and, the stems being naturally white, saleable heads are produced. They are, however, small and of poor quality. Even the so-called self-blanching varieties require moulding-up; the crispness that is essential in good celery cannot be secured without it, and trench growing is the best method.

Well-rooted plants should be prepared for planting, this saving a lot of trouble afterwards. If the plants are raised in boxes they should be left till all the soil is filled with roots. Some growers who plant very large numbers do not use boxes, but enclose spaces in the open by fixing battens. The site chosen for this purpose should have a hard surface, a yard being suitable. The space between the battens is filled with suitable soil, and the beds kept plentifully watered. The roots of the plants are confined to the few inches of added soil, and when the plants are lifted practically all the soil is carried by the roots. Such plants give very little trouble when they are placed in the trenches and a good watering given, and they hardly show a sign of being moved as the roots in the ball of soil are able to keep them growing.

In some cases the seedlings are pricked out on a garden plot. In such positions the roots ramble at will, and a ball of matted roots cannot be got. The advantage of this plan is that there need be no preparation for planting and very little watering. The disadvantages are that a grosser plant with a small number of roots results, and plants are more difficult to re-establish. This method answers very well where conditions are fairly favourable—that is, where the soil is not naturally very dry nor the climate very hot; it is the best plan for a hard-worked man. Before plants grown in this manner are transferred to the trenches they should be lifted, heeled closed together, well watered, and left for about a week. They will then have recovered from the check and made new roots which will not be injured in transplanting.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

WETHERS WITH INFLAMED PIZZLES.

G. H. W., Rakauroa :—

At crutching-time I found a number of wethers with large inflamed pizzles, and by shearing-time no improvement had taken place, while to my knowledge two had died in the interim. Could you advise me as to the cause of the trouble and advise treatment ?

The Live-stock Division :—

This is a condition confined to wethers, as these do not as a rule protrude the penis during urination. The pouch anterior to the penis fills up with sebaceous matter, decomposing urine, and urinary crystals. This sets up a state of chronic inflammation, urine is discharged with difficulty, and if the condition is allowed to go on death may follow either from blood-poisoning or a ruptured bladder. Treatment should be adopted as soon as the condition is noted. All wool should be removed from the parts, and the opening of the sheath enlarged, using a knife for this purpose if necessary. The whole sheath should be irrigated with a mild Condy's solution, and manipulated afterwards to break down any material still present. A little warm oil should then be injected. The wethers should be kept on sparse feed during treatment, and plenty of water supplied.

LAYING DOWN GRASS WITH OATS.

F. R. JEFFERD, Tokomaru Bay :—

Will you kindly advise me if the following plan for laying down a paddock in grass is a good one: Oats are sown in autumn and fed off until September, when grass-seed is broadcasted over the oats and a stroke of the tine harrows and roller given. This method would effect a considerable saving of labour, and the land would be in profit all the time. In this district oats are generally ready to cut by Christmas : would the grass have grown too high by this time ?

The Agricultural Instruction Branch :—

Grass is sometimes sown on oats in the spring as you suggest, but it is not quite a good practice. Usually the stand of grass so obtained is thin and patchy. It would be better to make a light sowing of oats in the autumn and sow the grass-seed at the same time, or, as an alternative, harvest the oat crop, work up the land, and sow in grass the following autumn. Grass sown in the spring would not interfere with the cutting of oats.

WEED-KILLER FOR PATHS.

"NOXIOUS WEED," Waipukurau :—

Will you kindly advise me how to prepare a cheap and effective mixture for the destruction of weeds growing on a path ?

The Horticulture Division :—

Dissolve 1 lb. of powdered arsenic in 3 gallons of cold water; boil the mixture, keeping it well stirred, and then add a further 7 gallons of cold water and 2 lb. of crushed washing-soda, continuing to stir the whole while boiling. This will be sufficient for spraying 25 square yards, and should be applied to the paths in

dry weather by means of a rose watering-can. An inclined board should be placed at the sides of the walks to keep the liquid off the grass or other "live" edging, which otherwise would be killed.

DESTROYING SWEETBRIER ON BUSH COUNTRY.

A. KINNELL, Manunui:—

Will you please advise me as to the best way of dealing with sweetbrier on bush country?

The Live-stock Division (Noxious Weeds Inspection):—

The only effective method of destroying sweetbrier-plants is to take them out by the root, and on bush country this would be done either by grubbing, or, if on country where horses or bullocks could be worked, by passing a chain around the bushes and dragging them out. The latter method is usually adopted where it can be worked.

COWS HOLDING MILK FROM MACHINES.

MATTHEWS AND DAVIES, Te Kowhai, Waikato:—

We should be glad if you could furnish us with any information as to the reason why cows hold their milk from the machines, and, if possible, state how this habit may be overcome. We are milking a large herd—mostly heifers—and find that some of the animals will give only part of their milk to the machines and hold the remainder. A few may be started again by hand, and then the machines reverted to, but others have to be milked out entirely by hand. When they first fail to respond to the machine and hand milking is resorted to they will let nothing down for a minute or two, their teats and udder having the feel and appearance of being milked out; then their teats will tighten somewhat and the milk will come.

The Live-stock Division:—

There are several reasons why cows withhold their milk from the machines, the chief being (1) rough handling, and (2) machines working at too high a pressure. It is, however, well known among dairy-farmers that when cows start to go off in their milk through shortness or dryness of feed, &c., they will not give their milk freely to the machines. About half the quantity only is given, and the remainder has to be milked by hand. In such cases owners find it more expeditious to revert to hand milking.

PROPAGATION OF FIG-TREES.

"FICITOR," Opoutama:—

Please inform me how fig-trees are propagated. Can they be grown from cuttings, and, if so, what is the best method?

The Horticulture Division:—

The time to make the cuttings is in the autumn, as soon as the leaves have fallen. Fig-trees are never quite dormant, but are nearest that state at the time mentioned. The sap soon begins to rise again, and then cuttings do not root well. Almost any part of the wood will make roots, and sometimes branches 3 ft. or 4 ft. long are inserted as cuttings. The best cutting is made from comparatively young wood. The cuttings need not necessarily be terminal growths; a branch of suitable wood will supply several cuttings; about 12 in. long is the best size. Cut through the centre of a joint; at this point the wood is solid and will make a good base for a cutting. The lower part of the cut will be solid also, and will make the top of another cutting. Plant at once in good soil, leaving only the two top buds above the soil. The base of each cutting must rest firmly on the soil, and the soil must be trodden very firmly around the part that is buried. This is to exclude air and prevent the cutting drying.

OATS AND TARES STRAW FOR FEEDING.

F. G. B., Otawhao Block, Takapau :—

I shall be threshing 15 acres of oats and tares about January or February. I am dairying, and shall require the straw for feeding to cows in winter. Could you advise me how to restore to the straw the feeding-value removed in the seed? In Scotland a kind of ensilage is made by adding molasses and salt, but I have not got a hopper.

The Agricultural Instruction Branch :—

It is not possible to fully restore the feeding-value after removing the grain, although a certain amount might be added by chaffing and sprinkling with molasses, especially if the material could be stored in a silo or hopper. A mixture of oat and tare straw is a very useful hay, and if saved under good conditions will be readily eaten by stock. Salt could be added at threshing-time—say, 56 lb. to every ton of material. The material could be further improved by sprinkling with molasses and water when feeding out, but this is not considered necessary.

BLOOD IN COW'S MILK.

F. R. Jefferd, Tokomaru Bay :—

Can you tell me the cause and treatment for blood-clots in a heifer's milk? They appear in the first few and final strokes in milking. There are no lumps in the udder, and the heifer appears particularly healthy and a good doer, although she calved at a very early age. She has been in milk about six weeks and the clots are still present.

The Live-stock Division :—

At the time of calving the udder gets considerably congested, and especially so in the case of heavy milkers. Probably at this period a small blood-vessel was injured, with the result that a little blood was passed out in the form of a clot at milking. The act of milking reopens the injury, and till this heals a variable amount of blood will come away, particularly with the strippings. Time alone will remedy the matter, though it would no doubt be beneficial if you went about the milking as carefully as possible, and did not strip right out.

TUTU AND STOCK.

"Piggy," Waitahuna :—

Can you inform me if it is safe to run pigs on ground where tutu is growing? Is the tutu likely to be more dangerous at one time than another—say, when the berries are on it?

The Live-stock Division :—

It is not safe to run pigs on ground where tutu is growing. Tutu contains an active principle called "tutin," which is poisonous to man and all domesticated animals and at all periods of the year. The poison is contained in the berries, leaves, stems, and roots. It is most tempting to children when the berries appear, and to sheep, cattle, &c., when the fresh green tender shoots are in evidence, and it is at these times that most cases of poisoning occur. When good feed is plentiful tutu is seldom touched by any animal, but to turn pigs on a section where this plant may be the only thing green would be very risky.

Areas in Orchards, Gardens, Tree-plantations, &c.—Particulars of the area in occupation in New Zealand under this class in 1920–21 (aggregated as 198,661 acres on page 59) are as follows: Commercial orchards—Bearing, 16,603 acres; not bearing, 9,235 acres; orchards for private use only, 5,669 acres; vineyards, 185 acres; market gardens, 3,578 acres; nurseries and seed-gardens, 371 acres; private gardens and grounds about residences, 58,802 acres; plantations, 104,218 acres.

OCCUPATION AND USE OF LAND IN NEW ZEALAND: 1919-20 AND 1920-21.

—	1919–20.	1920–21.	Increase.	Decrease.
	Acres.	Acres.	Acres.	Acres.
Grain and pulse crops	713,446	883,129	169,683	..
Grasses and clovers (cut for seed or hay), green and root crops	935,545	1,027,338	91,793	..
Sown grasses not cut for seed or hay	16,125,265	15,912,803	..	212,462
Fallow lands	81,760	137,898	56,138	..
Gardens, orchards, tree-plantations, &c.	148,760	198,661	49,901	..
Unimproved land	25,468,303	25,386,928	..	81,375
Total area of occupied land	43,473,079	43,546,757	73,678	..

DETAILS OF UNIMPROVED OCCUPIED LAND: 1920–21.

Land District.	Phormium Tenax.	Tussock and other Native Grasses.	Fern, Scrub, and Second Growth.	Standing Virgin Bush.	Barren and Unproductive Land.	Total Unimproved Occupied Land.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North Auckland ..	3,326	231,155	748,579	382,408	103,639	1,469,107
Auckland	8,058	292,793	1,034,875	736,559	57,751	2,130,036
Hawke's Bay ..	1,026	739,285	466,463	312,896	65,563	1,585,233
Taranaki	63	19,925	64,411	247,221	6,912	338,532
Wellington.. ..	16,943	461,958	309,999	422,458	101,952	1,313,310
Nelson	2,031	314,298	140,750	460,883	49,228	967,190
Marlborough ..	842	1,374,374	281,512	199,787	333,891	2,190,406
Westland	4,378	190,744	73,486	955,382	410,988	1,634,978
Canterbury.. ..	726	4,343,009	108,187	210,466	658,862	5,321,250
Otago	855	5,612,426	384,021	282,991	245,632	6,525,925
Southland	5,754	1,413,479	158,683	240,597	92,448	1,910,961
Totals	44,002	14,993,446	3,770,966	4,451,648	2,126,866	25,386,928

NOTES.—Land in boroughs is excluded from the above statistics. The total area of New Zealand is 66,292,232 acres.

IMPORTATION OF PLANTS, SEEDS, ETC., INTO ENGLAND AND WALES.

THE following recently issued order of the British Ministry of Agriculture, governing the importation of plants, seeds, &c., into England and Wales, is published for general information :—

The Destructive Insects and Pests Order of 1921, which comes into force on 1st October, 1921, prohibits the landing in England and Wales, from any country other than Scotland, Ireland, and the Channel Islands, of the following categories of plants, seeds, &c., unless each package in the consignment has attached thereto a copy of a certificate issued at the time of packing by a duly authorized official of the country from which it is exported : All living plants with a persistent woody stem above ground, and parts of the same, except seeds, when for use in propagation, such as fruit-trees, stocks and stools, forest-trees, and ornamental shrubs, and grafts, layers, and cuttings thereof ; all potatoes, and all tubers, bulbs, rhizomes, corms, and hop stocks for planting ; seeds of onions and of leeks for sowing ; and gooseberries.

The inspection must be made not more than thirty days prior to the date of despatch, and the certificate must state that the plants, seeds, &c., are healthy as regards common pests generally, and particularly the following : Fruit-tree cankers (produced by *Nectria ditissima* Tul., or any species of *Monilia*) ; silver-leaf (*Stereum purpureum* Pers.) ; black-currant mite (*Eriophyes ribis* Nal.) ; woolly aphis (*Eriosoma lanigerum* Hausm.) ; all scale insects (*Coccidae*) ; brown-tail moth (*Nygmia phoeorrhoea* Dan.), (*Euproctis chrysorrhoea*) ; rhododendron-fly (*Leptobyrsa* (*Stephanitis*) *rhododendri* Horv.) ; potato blackleg (*Bacillus atrosepticus* Van. Hall) ; American gooseberry-mildew (*Sphaerotheca morsuvae* Berk.).

And also that they are free from the insects and pests specified below : Fungi —Black-knot of plum and cherry (*Plowrightia morbosa* Sacc.) ; pear-blight (*Bacillus amylovorus* De Toni) ; chestnut-canker (*Endothia parasitica* (Murr.) Ander and Ander) ; wart disease of potatoes (*Synchytrium endobioticum*) ; onion and leek smut (*Urocystis cepuloe* Frost) ; downy mildew of hops (*Peronoplasmopara humuli*, Miy, &c., Taka). Insects—Vine-louse (*Phylloxera vastatrix* Planch) ; American apple-capsids (*Heterocordylus malimus* Reut. and *Lygidea mendax* Reut.) ; pear tingid (*Stephanitis pyri* Fab.) ; Colorado beetle (*Leptinotarsa decemlineata* Say.) ; plum curulio (*Conotrachelus nenaphar* Herbst.) ; potato-moth (*Phthorimoea operculella* Zell.) ; American luckey-moths (*Malacosma americana* Fab. and *M. diastri* Hubn.) ; Oriental fruit-moth (*Cydia molesta* Busck.) ; San Jose scale (*Aspidiotus perniciosus* Comst.) ; Japanese fruit-scale (*Diaspis pentagona* Newst.) ; apple fruit-fly (*Rhagoletis pomonella* Welsh) ; cherry fruit-flies (*Rhagoletis cerasi* Linn., *R. cingulata* Loew., and *R. fausta* Osten Saken) ; gooseberry fruit-fly (*Epochra canadensis* Loew.).

PROCEDURE TO BE FOLLOWED BY CONSIGNORS.

Persons sending to England and Wales consignments including any of the categories indicated in the first paragraph should take steps to ensure the inspection of the consignment by a duly authorized Government official, and obtain from him a certificate in the following terms :—

Certificate of Examination of Plants, &c.

No. .

THIS is to certify that the stock included in the package or consignment described below was thoroughly inspected by , an Inspector of , on ; the stock was grown by at ; and was found or believed by the Inspector to be healthy and free from any of the plant diseases or pests named in the Second Schedule to the above order.—(*Signed*) ..... (*Official status*) .....

Number and description of packages in consignment : ..... Distinguishing marks : ..... Nature of contents : ..... Name and address of exporter : ..... Name and address of consignee : ..... Name of vessel : ..... Port of shipment : ..... Port of landing in England and Wales : ..... Approximate date of arrival : .....

This certificate should be forwarded to the Horticulture Division, Ministry of Agriculture and Fisheries, Whitehall Place, London S.W. 1, at the time of issue. A copy must be affixed to each package in the consignment.

As indicated above, the inspection must be made not more than thirty days before the date of despatch. The certificate itself should be forwarded to the Horticulture Division, Ministry of Agriculture and Fisheries, Whitehall Place, London, England. Consignors should note that consignments arriving in England and Wales without the copy certificate attached to the packages will be detained at the port of entry, and will not be admitted into the country until they have been examined by an official of the Ministry of Agriculture and Fisheries and found to be healthy generally and especially free from the specified insects and pests. Consignments which are found to be unhealthy will be either disinfected, destroyed, or returned to the country of origin.

Potatoes.

In the case of potatoes, other than new potatoes (*i.e.*, potatoes landed in England and Wales on or before 31st July in the year in which they have been lifted), the certificate must also declare that wart disease has not occurred on the place where the potatoes were grown, nor within 500 yards thereof (approximately half a kilometre). New potatoes must be accompanied by a declaration in writing by the exporter stating that they have been lifted in the current year.

MAFFRA BEET-SUGAR FACTORY.

OPERATIONS AND RESULTS FOR SEASON 1920-21.

THE account of the operations of the Maffra Beet-sugar Factory published in the *Journal* for September, October, and November, 1920, is now supplemented by the following particulars for the 1920–21 season, kindly supplied by the Victorian Department of Agriculture :—

An area of 1,180 acres was harvested for 7,147 tons of beet, producing 833 tons of sugar. The price of beets was £2 5s. per ton. A particularly dry season was responsible for a very disappointing yield of roots, which averaged only 6 tons per acre. The roots gave a satisfactory yield of sugar (percentage of sugar in sliced beets, 15·13 ; percentage of purity, 83·4), but the profit of £5,276 was mainly due to the favourable sales of the previous season's stock, a price of £49 per ton being realized. The general expenditure was £39,203, and interest and depreciation amounted to £5,520.

The balance-sheet for the year is as follows :—Liabilities at 30th June, 1921—Capital, £84,671 ; profit and loss account (profit for year after interest and depreciation, £5,276, plus balance brought forward, £4,991), £10,267 : total, £94,938. Assets—Land, buildings, plant, &c., £49,886 ; debtors, &c., £10,910 ; stocks, £34,142 : total, £94,938.

In spite of the poor yield of beet obtained in the season under review, plantings for the 1921–22 season had already exceeded 1,600 acres by the beginning of December last, and it is considered that when the district irrigation scheme is developed the area devoted to sugar-beet production will be greatly extended. The demand for sugar is exceptionally keen.

STOCKS OF FLOUR, WHEAT, AND OATS.

THE usual census of stocks of flour, wheat, and oats in the Dominion was taken by the Government Statistician as at 30th November last. Returns were received covering all stocks owned or stored by millers, merchants, and farmers throughout the Dominion, with a few unimportant exceptions which would not appreciably affect the totals given. The totals are as follows, the corresponding figures for 1920 being shown in brackets in each case : Flour, 10,618 tons (9,209 tons) ; wheat in grain—milling, 891,016 bushels (1,078,013 bushels), other than milling, 77,060 bushels (58,791 bushels) ; wheat in stack (estimated), 2,453 bushels (4,658 bushels) ; oats in grain, 1,237,547 bushels (2,285,227 bushels) ; oats in stack (estimated)—for threshing, 46,012 bushels (16,895 bushels), for chaffing, 50,157 tons (18,569 tons).

Albany Fruit Show.—This show will be held on 18th February, not 25th February as previously announced.

EXPORT OF FRUIT, 1922 SEASON.

CONDITIONS OF GOVERNMENT GUARANTEE.

CONDITIONS for the Government guarantee of 1d. per pound net return on shipments have been formulated as follows :—

1. The guarantee to be limited to approved varieties and classes of fruit packed in compliance with the requirements of the "Extra Fancy" or "Fancy" grades as set out in the export regulations, and to be restricted to a maximum of 100,000 cases. All bushel cases must be wired or strapped.

2. The Government's liability under the guarantee to extend to the same charges for packing, shipment, &c., as have applied in the past. In this connection local charges up to placing the fruit on to the usual local wharf or railway-station not to exceed 3s. per case. All subsequent charges to be computed, provided they are reasonable and are legitimately connected with the placing of the fruit on the oversea market.

3. All fruit exported under the guarantee must be covered by an all-risk insurance policy.

4. The guarantee to be limited to fruit grown and shipped on consignment by or on account of *bona fide* fruitgrowers or fruitgrowers' co-operative societies through the New Zealand Fruitgrowers' Federation or other channels approved by the Minister of Agriculture.

5. The Government reserves to itself the right to limit the quantity of fruit shipped to any particular port should shipping accommodation, freight rates, or market conditions, &c., be deemed unsatisfactory.

6. All fruit to qualify for the guarantee must be passed by a departmental Inspector in the terms of the export regulations.

7. Claims under the guarantee shall be considered on the basis of the average price received by the claimant for the whole of the fruit exported on his account during the season, provided that where consignors ship fruit to more than one port shipments to each port to be considered separately in determining whether the guarantee is payable.

8. All fruit shipped under the guarantee to be forwarded to agents approved by the Department, and no shipper will be entitled to nominate more than one agent for each port.

9. Nomination of agents must be submitted to the Department at the beginning of the season.

EXPORT REGULATIONS.

With respect to the export regulations, it has been decided to allow the following modifications for the 1922 season :—

Classes.

The existing partial red and striped class will be separated and a distinct striped class instituted. The colour-requirements of the striped class will be 33⅓ per cent. and 20 per cent. respectively of good typical colour for "Extra Fancy" and "Fancy" grades.

Colour Standards.

Notwithstanding the provisions of the regulations, which will not be altered in this respect until further experience has been gained, apples carrying 10 per cent. less colour with respect to "Extra Fancy" and 5 per cent. less colour with respect to "Fancy" than is required by the regulations will be accepted during the 1922 season for export to Europe and South America. The above reduction in colour will apply to all the classes, including the "striped" class above referred to.

Grades of Fruit.

In addition to the grades "Extra Fancy" and "Fancy" it has been agreed, on the recommendation of the Fruitgrowers' Export Committee, that apples conforming to the undermentioned "Good" grade will be approved for export for the 1922 season :—

"Good" Grade : Apples of this grade shall be of not less size than 2½ in. (= 175 apples per case), sound, smooth, and clean. They shall be mature, well formed, hand-picked, true to name, and free from disease, visible bitter-pit.

skin-puncture, or skin broken at stem, and other defects. Slightly blemished apples may be included in this grade provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. Apples affected by spray injury may also be included in this grade provided that no individual apple shall have more than 10 per cent. of its surface affected thereby. The individual apples of "solid red," "partial red," and "striped" varieties shall carry not less than 30 per cent., 15 per cent., and 10 per cent. respectively of good typical colour. The individual apples of "yellow or green" varieties shall be of good characteristic colour.

Minimum and Maximum Sizes of Apples for Export.

The size of apples of "Extra Fancy" and "Fancy" grades approved for export shall be not less than 210 per case, with the following exceptions: With respect to the varieties marked * in the appended list the size shall be not less than 200 per case; with respect to the varieties marked † the size shall be not less than 240 per case. The size of any variety shall not exceed 96 per case.

Age of Trees.

The regulations restricting the export of apples to those taken from trees of seven years of age and upward will be relaxed sufficiently to allow apples from six-year-old trees of the varieties Jonathan, Statesman, and Dunn's (Monroe's Favourite) to be exported, provided that such fruit is duly approved by the Inspector, and that the maximum size is 130 per case.

Registered Export Number.

The "registered number" issued to all growers under the Local Market Regulations will be declared to be the grower's registered export number also. The registered number of each grower must be branded on each case of fruit exported by him. The characters used in connection with such number shall be not less than $\frac{3}{4}$ in. in the case of stencils.

In respect to fruit packed by a packing organization to which a registered number has been allotted, such consignments may be marked with the registered number of the packing association only, provided that each grower's fruit is shown separately on the advice-note for examination, and stacked in separate lots so that the Inspector may have no difficulty in determining which is the particular lot under examination. For example, a line of 100 cases of Cox's Orange coming from two different growers would be submitted as follows:—

Shipping Mark.	Registered Export Brand.	Number of Cases.	Kind of Fruit.	Variety.	Grade.	Size.
N.N. ..	TASMAN	14	Apples..	Cox's Orange ..	Fancy ..	163
	No. P002	14	,, ..	,, ..	,, ..	175
		8	,, ..	,, ..	,, ..	188
		12	,, ..	,, ..	,, ..	210
		12	,, ..	,, ..	,, ..	225
	Total ..	60				
N.N. ..	TASMAN	8	Apples..	Cox's Orange ..	Fancy ..	163
	No. P002	5	,, ..	,, ..	,, ..	175
		7	,, ..	,, ..	,, ..	188
		9	,, ..	,, ..	,, ..	210
		11	,, ..	,, ..	,, ..	225
	Total ..	40				

These would be stacked separately in two lots and examined as different lines.

Should unavoidable circumstances prevent the adoption of this procedure, resulting in a line comprising a large number of cases being submitted as one line, it must be definitely understood that the examination of same would be solely at the grower's risk, and in the event of any fruit forming a portion of the line being found to be unsatisfactory the whole line would be liable to rejection.

APPLES AND PEARS APPROVED FOR EXPORT.

APPLES.

Solid Red Varieties.

Baldwin.	Spitzenberg.	Tasma.
Hoover.		

Partial Red Varieties.

Crofton.	King David.	Shepherd's Perfection.
Delicious.	*Rome Beauty.	Wealthy.
Dougherty.	Scarlet Nonpareil.	Worcester Pearmain.
John Sharp.	Scarlet Pearmain.	Yates.
†Jonathan.	Sharp's Late Red.	

Striped Varieties.

Adams Pearmain.	Gravenstein.	Rymer.
Allington Pippin.	Premier.	Statesman.
†Cox's Orange.	Ribston Pippin.	Stayman.

Yellow or Green Varieties.

Alfriston.	*Dunn's.	Parlin's Beauty.
Ballarat.	Golden Pippin.	Reinette du Canada.
Boston Russet.	Grannie Smith.	Sturmer.
Brownlee's Russet.	London Pippin.	Willie Sharp.
Cleopatra.	Newtown Pippin.	Washington.

PEARS.

Bachelier.	Directeur Hardy.	L'Inconnue.
Beurre Bosc.	Doyenne du Comice.	Packham's Triumph.
Beurre Capiaumont.	Durondeau.	P. Barry.
Beurre Clairgeau.	Elizabeth Cole.	Twyford's Monarch.
Beurre d'Anjou.	Giblin's Nelis.	Winter Cole.
Beurre Diel.	Glou Morceau.	Winter Nelis.
Beurre Easter.	Josephine de Malines.	

FORTHCOMING AGRICULTURAL SHOWS.

Woodville A. and P. Association: Woodville, 24th and 25th January.
Pahiatua A. and P. Association: Pahiatua, 27th January.
Te Puke A. and P. Association: Te Puke, 2nd February.
Clevedon A. and P. Association: Clevedon, 4th February.
Feilding I., A., and P. Association: Feilding, 7th and 8th February.
Matamata A. and P. Association: Matamata, 9th February.
Dannevirke A. and P. Association: Dannevirke, 8th and 9th February.
North Kaipara Agricultural Association: Paparoa, 10th February.
Masterton A. and P. Association: Solway, 14th and 15th February.
Omaha and Pakiri A. and P. Association: Leigh, 15th February.
Waimarino A., P., H., and I. Association: Raetihi, 16th February.
Hauraki Plains A. and P. Association: Ngatea, 18th February.
Rodney Agricultural Society: Warkworth, 18th February.
Rangitikei A. and P. Association: Taihape, 23rd February.
Franklin A. and P. Society: Pukekohe, 24th and 25th February.
Marton District A. and P. Association: Marton, 1st March.
Rotorua A., P., and I. Association: Rotorua, 1st March.
Katikati A. and P. Society: Katikati, 9th March.
Morrinsville A., P., and H. Society: Morrinsville, 15th March.
Ashburton A. and P. Association: Ashburton, 15th and 16th March.
Murchison A. and P. Association: Murchison, 17th March.
Hawke's Bay A. and P. Society: Hastings (Autumn Show), 21st and 22nd March.
Mayfield A. and P. Association: Mayfield, 24th March.
Methven A. and P. Association: Methven, 30th March.
Temuka and Geraldine A. and P. Association: Temuka, 30th March.
Oxford A. and P. Association: Oxford, 6th April.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)